Contents

THEME ONE : **Systems**

UNIT ONE : Living Systems

Concept **1.1**

Adaptation and Survival :

- Lesson 1 14
- Lesson 2 19
- Lesson 3 26
- Lesson 4 33
- Lesson 5 46
- Lesson 6 53

Concept **1.2**

Sense at Work :

- Lesson 1 60
- Lesson 2 65
- Lesson 3 70
- Lesson 4 73
- Lesson 5 75
- Lesson 6 78

Concept **1.3**

Light and Sight :

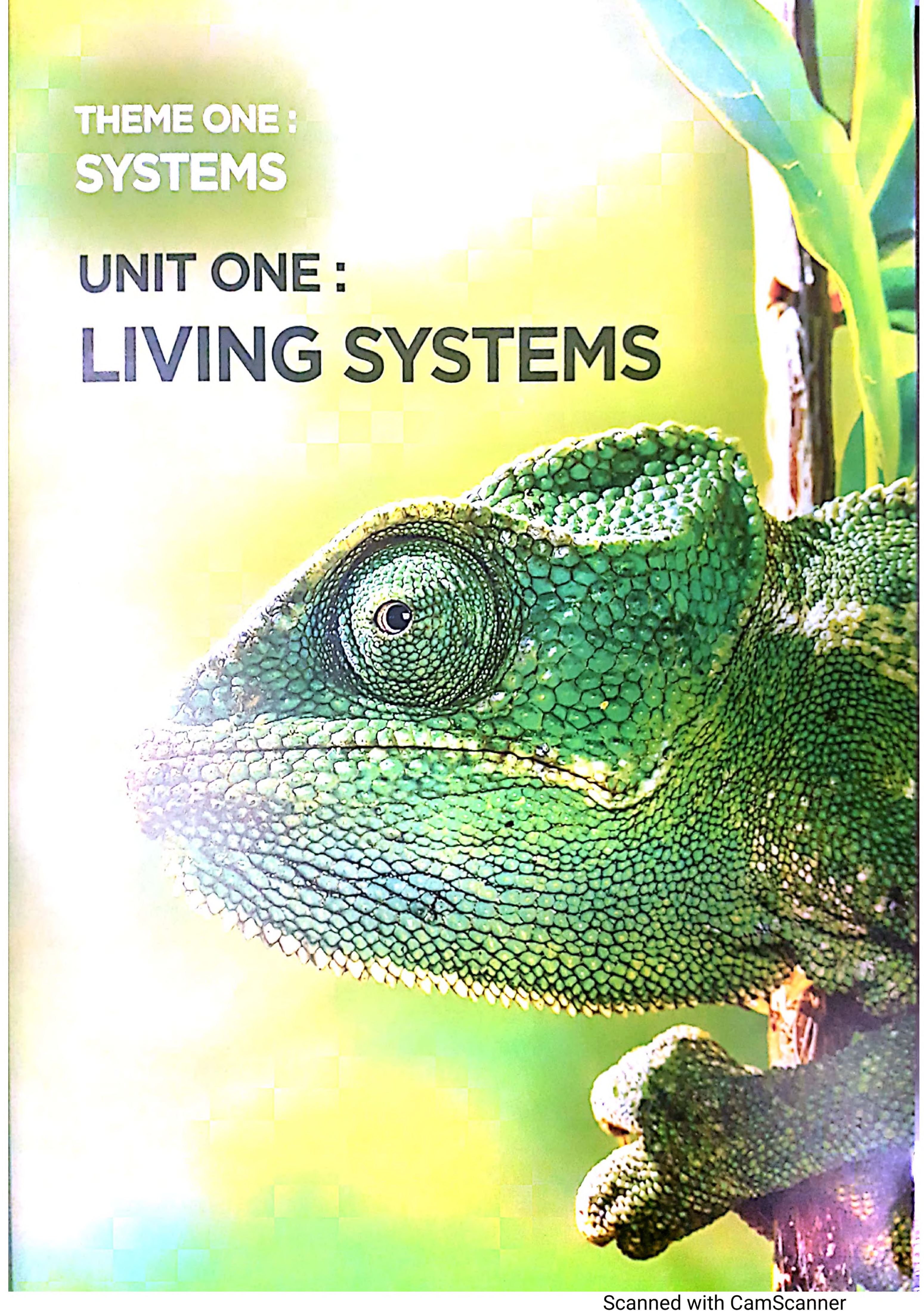
- Lesson 1 82
- Lesson 2 88
- Lesson 3 92
- Lesson 4 95
- Lesson 5 100
- Lesson 6 102

Concept **1.4**

Communication and Information Transfer :

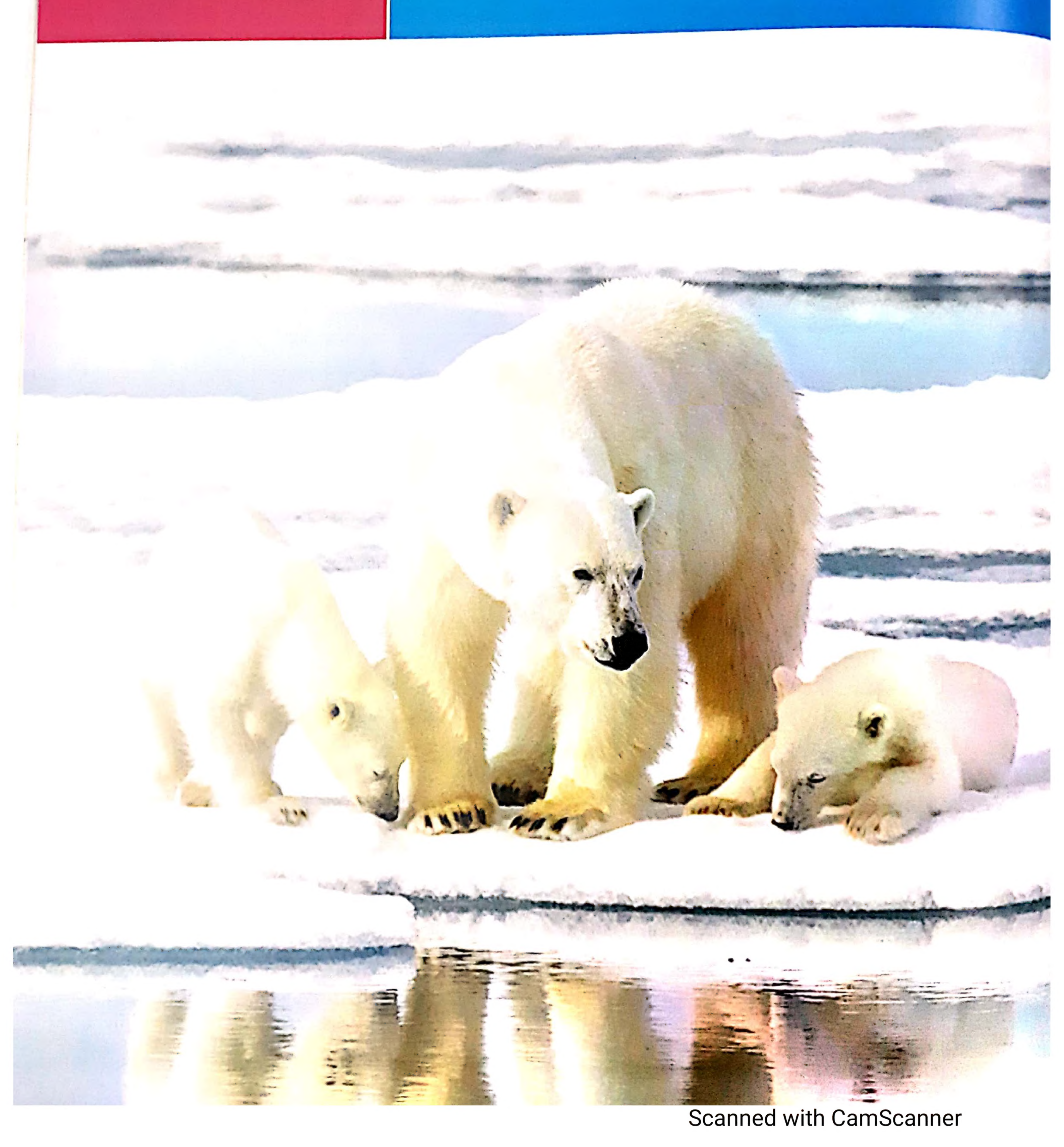
- Lesson 1 108
- Lesson 2 114
- Lesson 3 119
- Lesson 4 122
- Lesson 5 127
- Lesson 6 130

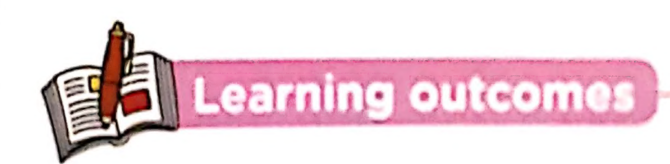
- Unit Project 131
- Interdisciplinary Project 133
- Glossary 136


THEME ONE :
SYSTEMS
UNIT ONE :
LIVING SYSTEMS

Concept 1.1

Adaptation and Survival





Learning outcomes

By the end of this concept, your child will be able to :

- Model the relationships among an organism's survival, habitat, adaptations, and body systems.
- Argue from evidence that plants and animals have structures and behaviors that help them survive and grow.
- Explain how structural adaptations help organisms survive in specific environments.
- Argue from evidence that multiple adaptations or organs work together in systems to help organisms survive in specific habitats.

Key vocabulary

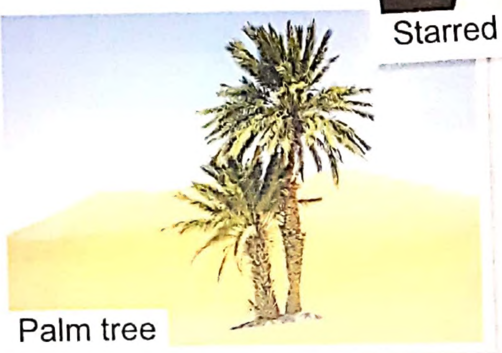
- Adaptation
- Arctic
- Camouflage
- Digestive system
- Disease
- Ecosystem
- Energy
- Extinct
- Feature
- Hibernate
- Migration
- Ocean
- Organism
- Pollute
- Predator
- Prey
- Reproduce
- Stomach
- Survive
- Trait

Lesson 1

Activity 1

Can You Explain?


Starred agama lizard


Palm tree


Human being

▸ **Do you notice how each of the previous living organisms protect itself from extreme heat of the Sun ?**

- **Starred agama lizard** that lives in the desert protects itself by keeping itself cool by finding shaded area during a hot sunny day.
- **Palm leaves** are covered with waxy layer to protect them from extreme hot climate.
- **Human being** protects himself from extreme hot climate by using umbrella and light clothes.

▸ **Each of the previous living organisms has its own way to protect itself from extreme hot climate, and these different ways are known as " Adaptation ".**

Adaptation :

It is a characteristic of living organisms that allows them to change over generations and helps them to survive and reproduce in the ecosystem.

▸ **In this chapter, we will study :**

- Types of adaptation.
- Adaptation in some plants.
- Adaptation in some animals.
- Adaptation in human.

Notes for parents

- Explain to your child how living organisms can adapt to the environment in which they live.

Activity 2

Penguin Feet

▸ **Climate is considered one reason for adaptation of many living organisms over generations.**

- Can you stand on ice in barefeet for about 5 minutes.



- Can a penguin walk on ice for a long period of time ?



▸ **Adaptation of penguins to survive in cold environment :**

- Penguin makes different adaptations to be able to live in **polar climate** that is characterized by extreme cold.

- **Its habitat :**

  They live in Antarctica that is one of the coldest places on the Earth.

- **Its adaptation :**

  Let's know how the penguin's feet don't freeze in the cold environment :

- **Penguin has an insulating layer of fat and thick downy feathers** that trap warm air against the skin to keep its body warm in the freezing cold.
- Although the penguin toes' feet have no feathers, no fat, it can stand around on the ice all the day. This happens due to the way of movement of blood in blood vessels through the penguin's feet.

▸ The way of moving the blood through the penguin's feet to keep them warm :

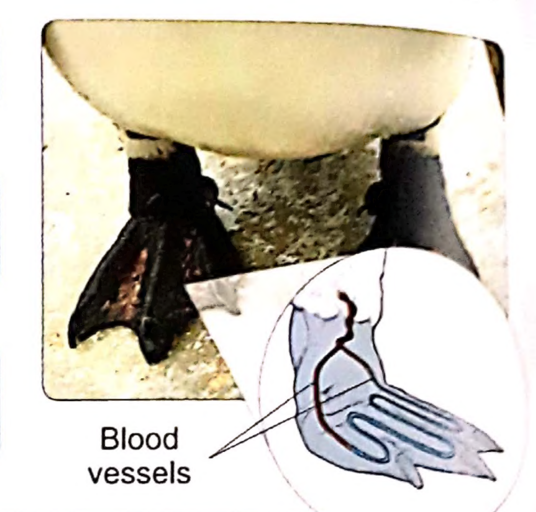
Blood vessels bring cold blood up from the feet.



Other blood vessels bring warm blood down to the feet from the feather-coated body.



The warm blood vessels weave around the cold blood vessels.



When they meet, the warm blood vessels heat up the cold blood vessels, so the heat transfers to the penguin's feet.

- **This means that the blood moving up into the penguin's body is not cold and the blood moving down to the penguin's toes is warm enough to keep its toes from freezing.**

Check your understanding

▸ Put (✓) or (✗):

1. The blood vessels coming upwards from the penguin's feet carry warm blood. ( )
2. Penguins can adapt to live in extreme cold environment by having feathers and fat in their feet. ( )

▸ Look at these pictures, then answer the question :

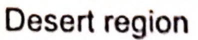
- In your opinion, what is the suitable environment from the opposite environments in which the penguin can live ? (Give a reason for your choice).

....

....

....




Desert region


Forest region


Polar region

Notes for parents

- Discuss with your child how the movement of blood inside the penguin's feet helps it keep its feet warm.

Activity 3

Adaptations for Survival

- **You have known that adaptation help living organisms to survive and reproduce in the ecosystem in which they live.**
- **Now, you will study camouflage as an example of adaptation.**

Camouflage :

It is an example of adaptation in which some animals hide from their predators or their preys by blending in with the surrounding environments.

- **Adaptation of some animals to survive in their environments through camouflage :**

1 Polar bear



Polar bear

- **Its habitat :**
  It lives in the arctic region.
- **Its adaptation :**
  It has white and thick fur :
  - **Its white fur** to help it blends in with the snow as it sneaks up on its prey.



Note
Its thick fur to help it stays warm in its cold arctic home.

2 Brown bear and dark bear :

- **Their habitat :**
  They live in forests.
- **Their adaptation :**
  They have dark fur to help them stay hidden among the trees as they hunt.





Dark bear



Brown bear

③ Caracal and fennec fox

- **Their habitat :**
  They live in **desert**.
- **Their adaptation :**
  They have sandy-colored fur (tan-colored fur) to help them hide and blend in with desert landscapes.



Caracal


Fennec fox



Some types of lizards

- **Their habitat :**
  Some types of lizards live in desert, while other types live in other environments among quite colorful rocks.
- **Their adaptation :**
  They have colorful scales that make them hard to see among the rocks.


Lizard



Check your understanding

▶ **Put (✓) or (✗) :**

1. Polar bear has a dark fur to blend in with the snow. (   )
2. In a polar region, a fennec fox preys a young polar bear. (   )

▶ **Choose :**

- In the polar region, a polar bear sneaks up on .... to get its food.


a. Penguin


b. Camel


c. Fennec fox


d. Tiger

In the Exercises Book :
Try to answer :
- Exercises on Lesson ① p. 5
- Self-Assessment ①

Notes for parents

- Let your child explains how caracal, fennec fox and some types of lizards can adapt to live in their environments through camouflage.

Lesson 2

Activity 4

Types of Adaptations

▶ **Classify the following animals according to the environments where they live in :**


Fennec fox

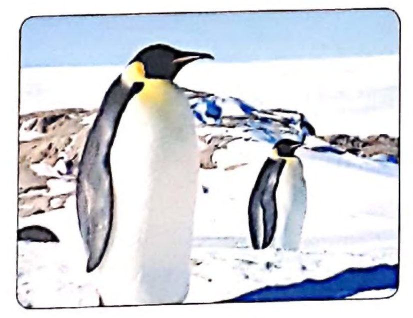

Polar bear


Bull shark


Camel


Desert lizard


Arctic fox


Penguin


Octopus

Cold polar regions	Hot deserts	Oceans
....	....	....
....	....	....
....	....	....

- You have known that adaptation is a change made over generations that helps the animals to survive.
- **Now,** you will study the types of adaptations.

- Help your child to classify the previous animals according to their suitable environments.

Types of adaptations

1. Structural adaptation (or physical adaptation)	**2. Behavioral adaptation**

Definition

It is a change in the structure of the animal's body to adapt its environment.

It is a change in the behaviors or acts of a group of animals to adapt its environment.

Examples

Structural adaptation:

- The blood vessels in the penguin's feet.



- The thick fur of the polar bear.



Behavioral adaptation:

- Desert lizard looks for shade during hot sunny days.



- Migration of some animals towards certain regions.



(Migration means : travelling of some animals long distances at certain time of the year).

▶ Adaptation of foxes to survive in their environments :

- Fennec foxes and arctic foxes both live in dry desert climates.

1 Fennec fox

- **Its habitat :**

  It lives in hot deserts.

- **Its structural adaptation :**
  - **It has a tan-colored coat (sandy-colored fur) that :**
    - provides camouflage to hide in a sandy, rocky environment.
    - protects it from the hot Sun.
  - **It has extra-large ears** that help the fennec fox to lose the heat to cool its body.
  - **It has a special shape of ears** that allow excellent hearing to help fennec fox hunts.



Fennec fox

- **Its behavioral adaptation :**
  - **It pants like dogs,** where it takes up to 700 breaths per minute to cool its body.
  - **It lives in burrows** which are excellent places to stay cool during the sunny days.
  - **It eats different kinds of food,** like insects, fruit, plant roots and even leftovers from another animal's prey because food can be hard to find at the hot, dry deserts.



2 Arctic fox

- **Its habitat :**

  It lives in tundra which is a different type of deserts with temperature as cold as (50°C) below zero in the winter months.



Arctic fox in winter

- **Its structural adaptation :**
  - **It has a thick fur coat** to keeps its body warm in extreme cold climate.
  - **Its fur coat is white during winter, but turns brown in summer when the snow melts** to help it sneaks up on prey in any season.
  - **It has short ears and legs** to help it stays warm.
  - **It has a special shape of ears** that allow excellent hearing to help arctic fox hunts.



Arctic fox in summer

- Discuss with your child the habitat, structural adaptation and behavioral adaptation of the fennec fox and arctic fox.

- **Its behavioral adaptation :**
  - **It lives in burrows** which are excellent places for it to stay warm at night.
  - **It eats different kinds of food,** like insects, fruit, plant roots and even leftovers from another animal's prey because food can be hard to find at the cold tundra.



Adaptation of bull shark to survive in its environments :

- There are many types of sharks, most of them can only live in **salt** water.
- One of the amazing types of sharks is the **"bull shark"** that its body is adapted to survive in both **salt** water and **fresh** water.

3 Bull Shark

- **Its habitat :**
  It lives in fresh water and salt water.
- **Its structural adaptation :**
  - **Its body is adapted to survive in fresh water,** so it has a unique advantage over other sharks.
  - **It has a dark back and white belly that causes the following :**
    - When an animal swimming **above** the bull shark looking down into the ocean may not see the shark in the shadows due to its **dark back.**
    - When an animal swimming **underneath** the bull shark and looking up, the bull shark may blend in with the bright light of Sun due to its **white belly.**

    So, the bull shark can sneak up on prey using a camouflage strategy called "countershading".
  - **It has sharp teeth** to help it sneak up its preys and tear their flesh.

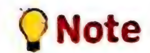


Bull shark

- **Its behavioral adaptation :**
  - **It can hunt in different places** like salt water or fresh water, so it can feed on different types of food.
  - **It hunts in the day as well as the night,** so its prey cannot predict when this shark will hunt next time.

Notes for parents

- Discuss with your child the habitat, structural adaptation and behavioral adaptation of the bull shark.



Note

In fresh water, bull sharks have less competition for finding food, because there are no other sharks live in fresh water to share the bull shark its food.

Check your understanding

▸ Write the scientific term :

1. It is a change in the structure of the animal's body to adapt its environment. (..........................)
2. It is a change in the behaviors or acts of a group of animals to adapt its environment. (..........................)

▸ Use the following structural and behavioral adaptations of the following animals to complete the table below :

Hunts in day and night – Tan coloration – Panting – Sharp teeth – Short ears and legs – Big ears – Can live in fresh water – Camouflage by season – Countershading.

Animals	Structural adaptation	Behavioral adaptation
Fennec fox	• .... • .... • Strong sense of hearing.	• .... • Living in a burrow. • Eat different kinds of food.
Arctic fox	• .... • .... • Strong sense of hearing.	• Living in a burrow. • Eat different kinds of food.
Bull shark	• .... • .... •	• Eat different kinds of food. • ....

• Let your child answer the questions to check his/her understanding.

Activity 5

Panther Chameleon

- You have known that there are many types of lizards that are found all over the world in different environments.
- **Lizards** are from reptiles that are an ancient type of animals.
- Bodies of reptiles such as lizards are covered with scales.

Examples of lizards :



Starred agama lizard
(lives in very hot desert).



Panther chameleon
(lives in tropical rainforest).

Adaptation of the panther chameleon to survive in its environment :

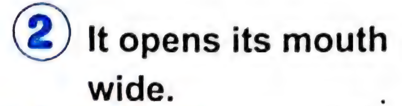
Panther chameleon

- **Its habitat :** It lives in the tropical rainforest.
- **Its structural adaptation :**
  - **It has brightly colored scales** that provide camouflage with its surrounding environment that contains green leaves and colorful flowers.
  - **Chameleon eyes move in opposite directions**, where each eye can move independently from the other, so :
    - One eye can be searching for something to eat like insects, while the other eye is on the lookout for danger in a totally different direction.
    - This adaptation allows the panther chameleon to hunt its prey and avoid becoming a prey at the same time.
  - **It has a very long sticky tongue** to hunt insects for feeding.
  - **It has V-shaped feet and a tail like a hand** to hold tightly the branches of trees.

Notes for parents

- Discuss with your child the structural and behavioral adaptations of the panther chameleon.

- **Its behavioral adaptation :**
  - When chameleon finds itself in danger, it doesn't have teeth or claws for defense, but it has one last trick to scare its attacker, where it appears as fierce as the following :



1. **It puffs up its body with air.**
2. **It opens its mouth wide.**
3. **It changes the colors of its scales.**



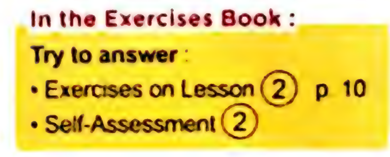




Check your understanding

▸ **Complete the following table which describes the types of adaptations that help chameleon to survive :**

Adaptation	Type of adaptation : Structural (S) or Behavioral (B)	This adaptation helps chameleon to ......
Bright colored scales.	....	Camouflage to hunt and hide.
....	....	Balance and move.
Eyes move in different directions.	....	....
....	....	Scare its enemies.
Changing colors.	....	Scare its enemies.


In the Exercises Book :
Try to answer :
- Exercises on Lesson (2) p. 10
- Self-Assessment (2)

- Help your child complete the table to differentiate between different types of adaptations in panther chameleon.

Lesson 3

Activity 6

Plant Adaptations

▸ **Look at these plants, then choose the correct answer :**



1 Water lily plant :

Water lily plant grows and survives in .... (desert – snow – wetland)

2 Pine trees :

Pine trees grow and survive in .... (desert – snow – wetland)

3 Cactus plant :

Cactus plant grows and survives in .... (desert – snow – wetland)

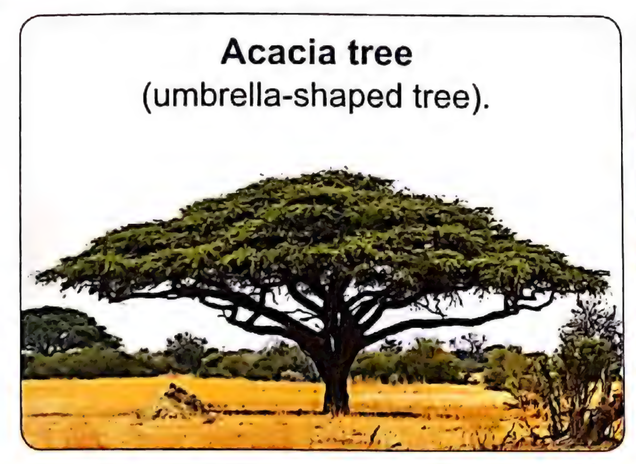
- From the previous examples of plants, we notice that the different types of plants are adapted to survive in different environments.
- Plants can grow in every place that sunlight shines, even the bottom of sea ice in polar regions has tiny plants growing on it.
- Like animals, plants have structural and behavioral adaptations that help them survive and grow in their environments.

Notes for parents

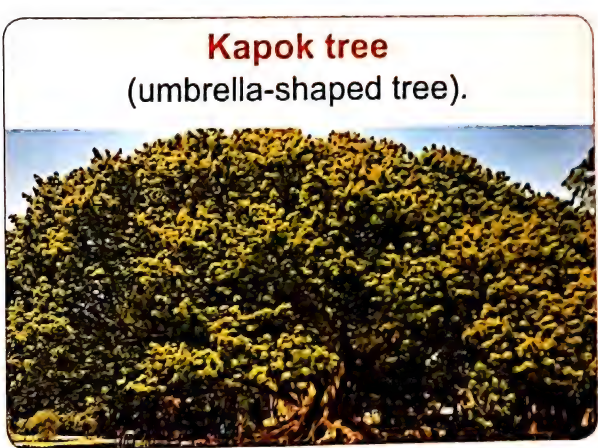
• Let your child observe the photos and think where each of the previous plants can grow & survive.

▶ **Now,** we will study two terrific trees which are :

Acacia tree
(umbrella-shaped tree).



Kapok tree
(umbrella-shaped tree).



Two terrific trees

The two previous trees grow in two different environments, where acacia tree lives in **savannah forest** in Southern Africa and kapok tree lives in **Amazon rainforest** of Brazil.

- **Characteristics of savannah forest in Southern Africa :**
  - Savannah forest is a grassland habitat.
  - The temperature in the savannah forest is mild.
  - In the savannah, there is extreme lack of water during the dry season which lasts for half of the year without rainfall.
  - Savannah forest is characterized by drought conditions, so most of large plants can't grow.
  - When you look over the savannah, you can see one large tree scattered through out the landscape which is acacia tree (umbrella-shaped tree).



Savannah forest

- **Characteristics of Amazon rainforest of Brazil :**
  - In the rainforest, it is easy to find water, where it is rainy most of the year.
  - It is hard for plants in the rainforest to reach sunlight.
  - The rainforest has a soggy soil which means that it is a wet muddy soil.
  - The rainforest is characterized by strong winds.
  - The trees in the rainforest grow up to 70 meters tall, there is a tree that emerges high above other trees which is kapok tree (umbrella-shaped tree).



Amazon forest

• Discuss with your child the characteristics of savannah forest and Amazon forest.

▶ Adaptation of the two terrific trees to survive in their environments :

1 Acacia tree (umbrella-shaped tree)


Acacia tree

- **Its habitat :**

It grows in savannah forest in Southern Africa.

- **Its structural adaptation :**

Root

- **It has a very long root** grows directly downward known as the "taproot".
- This root searches for water as deep as 35 meters below the soil surface.

Trunk

- **Its trunk is very long,** so most animals except giraffe cannot reach its leaves to feed on.
- Acacia tree stores water in its trunk.

Leaves


Leaves of Acacia tree

- It has tiny leaves growing on its top to help it hold in water, while soaking up sunlight needed to make food.
- Its leaves have sharp spines to protect them from hungry mouths of animals.

Notes

- Acacia is adapted to survive through many months of drought in its environment.
- The trunk in acacia tree stores water as the hump in the camel stores fat.

- **Its behavioral adaptation :**

Acacia tree can defend itself as follows :

- When an animal begins eating the leaves of the acacia, the tree also begins to **produce a poison** that makes the leaves taste very bad.
- Then it **sends a smelly message in the wind** to acacia trees nearby telling them to start making the same poison.

Notes for parents

- Discuss with your child the habitat, structural adaptations and behavioral adaptations of acacia tree

2 Kapok tree (umbrella-shaped tree)


Buttress roots

Buttress roots of kapok tree

- **Its habitat :**

  It grows in the Amazon rainforest of Brazil.

- **Its structural adaptation :**

Root

- The kapok tree stays firmly rooted due to large, wide roots called buttress roots.
- Buttress roots are not planted deeply in the ground but they grow high up on its trunk to hold the tree firmly in the soggy soil.


- Some of these roots can start up to 5 meters above the ground.

Leaves


Leaves of Kapok tree

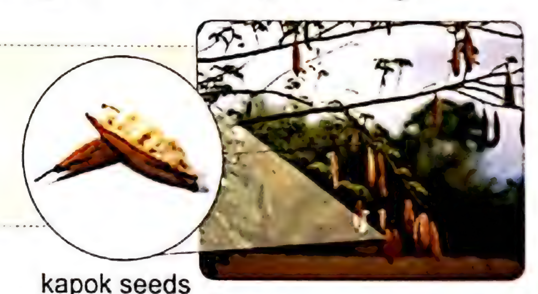
It has hand-shaped leaves with narrow parts that allow wind to move more gently through the leaves without tearing them.



- **Its behavioral adaptation :**
  - The kapok tree uses the wind to send a different type of messages than the acacia, where the kapok tree invites bats to come visit its delicious-smelling flowers through these smelly messages.

Note

The wind also carries the tree's fluffy yellow seeds across the forest.


kapok seeds



Check your understanding

Look at this picture below, then answer the question :

- Do you think this giraffe can continue eating a lot of leaves of acacia tree ? (Give a reason for your answer).







....

• Discuss with your child the habitat, structural adaptations and behavioral adaptations of kapok tree.

Activity 7

Plant Scientist

Plants have different properties that help them to survive in their environments as they grow in different ways according to the environmental conditions as we will study in the following examples :

Plant	Its habitat	Its structural adaptation	This adaptation helps the plant to survive because
Mangrove tree	Salt water	It has long and strong roots.	The long and strong roots help the plant **to resist the waves.**
Water lily	Wetland	It has wide leaves that float on the water surface.	The wide leaves help the plant **to absorb a big amount of sunlight.**
Palm tree	Desert	- It has thick roots. - It has small leaves.	Both thick roots and small leaves help the plant **to resist the strong winds.**
Pine tree	Snow	- This tree has a triangular shape. - It has short branches. - It has needle leaves.	- The triangular shape of this tree and its short branches **allow the snow to slide easily over it, so its branches don't break.** - The needle leaves **prevent the plant from losing of water.**

Notes for parents

- Discuss with your child the properties of some plants that help them to survive in different environments.

Acacia tree	Savannah	Its branches grow and gather on the top of its trunk.	The branches at the top of its trunk **prevent the animals from reaching the leaves on the tip of these branches.**
Barbary fig	Desert	It has sharp spines.	The sharp spines **prevent the animals from eating its leaves and fruits.**

From the previous table we can conclude that :

- All plants have roots, stems (trunks) and leaves.
- Plants differ in the structure and shape of their roots, stems and leaves to adapt the environmental conditions to survive and grow in their environments.

What happens if ... ?

A plant is taken from its original environment and placed in another different environment.

This plant may die or may adapt the new environmental conditions to survive and grow in its new environment.

Check your understanding

Put (✓) or (✗) :

1. Palm tree has short roots and big leaves. ( )
2. Water lily plant live in salt water. ( )
3. Mangrove tree has long and strong roots to help the plant to resist the waves. ( )

Activity 8

Identifying Adaptations

You have known from the previous explanation that plants live in different environments and they adapt the different environmental conditions in their ecosystem through the structure of leaves, stems (trunks) and roots.

▸ Look at these photos, then choose the correct answer :



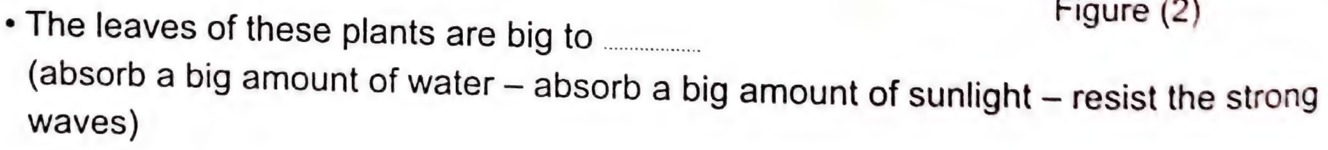
Figure (1)

- These plants grow and survive in ....
  (snow – desert – rainforest)
- The roots of these plants are .... to absorb a big amount of water.
  (short – long – small)
- The leaves of these plants have sharp spines to ....
  (prevent the animals from eating them – absorb a big amount of water – absorb a big amount of sunlight)
- The shape of the roots and leaves of these plants is considered as ....
  (structural adaptation only – behavioral adaptation only – structural and behavioral adaptations)



Figure (2)

- These plants grow and survive in ....
  (snow – desert – rainforest)
- The roots of these plants .... because it is easy to find water.
  (grow deeply in the soil – grow near the soil surface – come out of their leaves)



- The leaves of these plants are big to ....
  (absorb a big amount of water – absorb a big amount of sunlight – resist the strong waves)
- The shape of the roots and leaves of these plants is considered as
  (structural adaptation only – behavioral adaptation only – structural and behavioral adaptations)

In the Exercises Book :
Try to answer :
• Exercises on Lesson (3) p. 17
• Self-Assessment (3)

Notes for parents

- Help your child observe the photos, then answer the questions to know how to identify different adaptations in different plants.

Lesson 4

Activity 9

Digestive System

▶ **Observe the following figures, then complete the sentences below :**

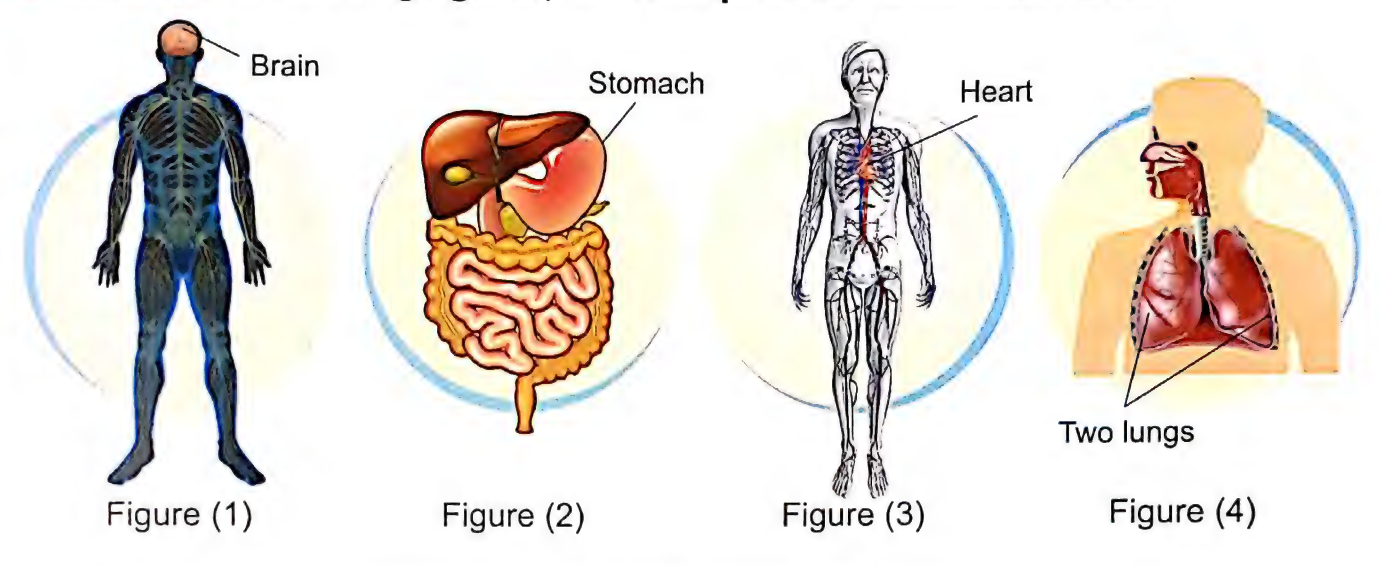


Figure (1) Figure (2) Figure (3) Figure (4)

- Figure .... represents the human digestive system.
- Figure .... represents the human respiratory system.

▶ **How are body systems adapted to meet the needs of living organisms ?**

- **Each living organism has different ways to adapt to the environment in which it lives, so :**
  - The body of a living organism (human or animal) consists of some systems, that are differ in their structures to perform specific functions to get its needs of food, breathing, ... etc.
  - Each system consists of a group of organs that are working together to perform a specific function.
  - Digestive system and respiratory system are examples of systems found in the body of human or animal.

Note

Digestive system and respiratory system are working together to get energy from food and breathing.

- The body gets nutrients from food that provide the body with the needed energy.
- The body needs energy to :

Do activities , such as (walking, talking or sleeping).

Do functions inside it, such as (heart beating, breathing and thinking).

• Help your child to identify the human body systems especially, the digestive system and the respiratory system.



Note

In one day, you need a lot of energy, your heart beats around 100.000 times, you take over 20.000 breaths, and thousands of steps.

• In this lesson, we will study :

1. Human digestive system.
2. Digestive systems of some animals and comparing them with the human digestive system.
3. Human respiratory system.

Human digestive system

• To get nutrients from food, it must pass through different organs of the digestive system which are working together to break down food into smaller parts that your body can use in a process called digestion process.

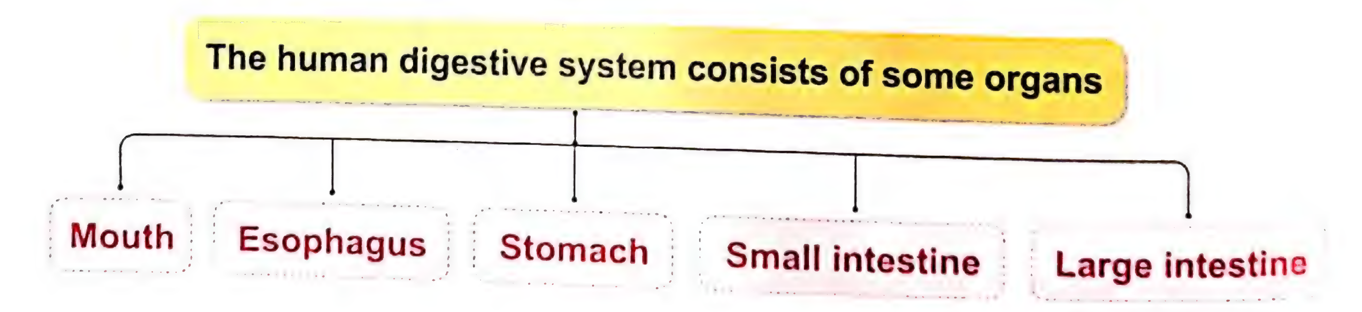
Digestive system :

It is the system responsible for breaking down food into small parts to enable the body cells to use them in getting energy.

Digestion process :

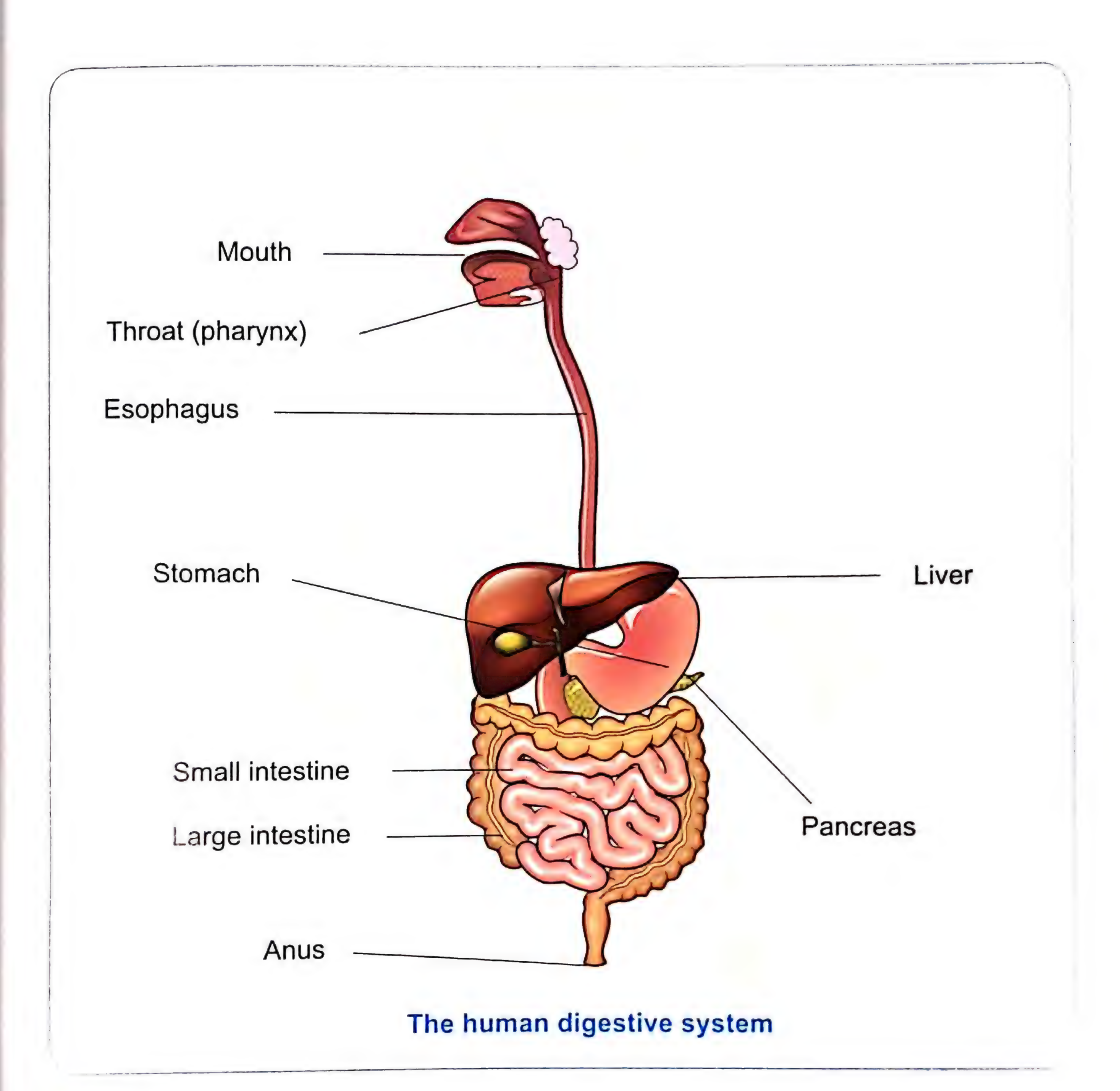
It is the process of breaking down food and changing it into chemical substances that the body absorbs and uses them in getting energy and growth.

The structure of the digestive system :



Notes for parents

• Discuss with your child the importance of the digestive system and the meaning of digestion process.



The human digestive system

Notes

- Digestive system starts with **mouth** and ends with **anus**.
- The organs of the digestive system are connected and organized in a way that allows food to complete the process of digestion, starting from the mouth to the stage of excretion.

• Help your child to identify the organs of the digestive system.

1 Mouth

- Digestion begins in the mouth.
- **Mouth contains :**
  1. Teeth.
  2. Saliva (it is a liquid substance in the mouth).
  3. Tongue.

Teeth

Tongue

- Function of teeth :

They break down and crush food in the mouth during chewing.

- Function of saliva :

- It helps in the digestion of some types of food, (where it digests starch and changes it into sugar).
- It facilitates the swallowing of food.

- Function of tongue :

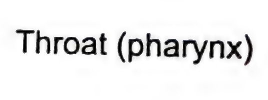
It mixes food with saliva in the mouth.

2 Esophagus

- During swallowing the food, the throat (pharynx) pushes the food into a tube called esophagus.
- Esophagus is a long muscular tube.

- Its function :

It moves the food down into the stomach.







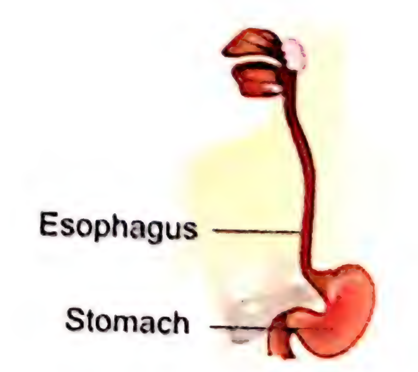
3 Stomach

- It is a muscular organ.

- Its function :

The stomach mixes food with the stomach acid and digestive juices (enzymes) found in it to change the food into a soupy liquid.

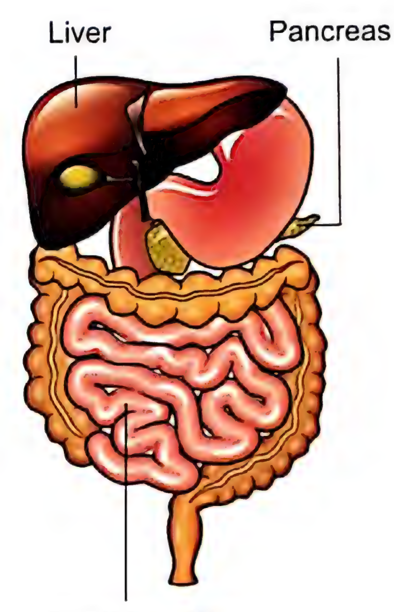
- Food stays in the stomach for a few hours, then the muscles of the stomach move the food into a long, winding tube called small intestine.



Notes for parents

- Discuss with your child the functions of mouth (teeth, saliva, tongue), esophagus and stomach.

4 Small intestine



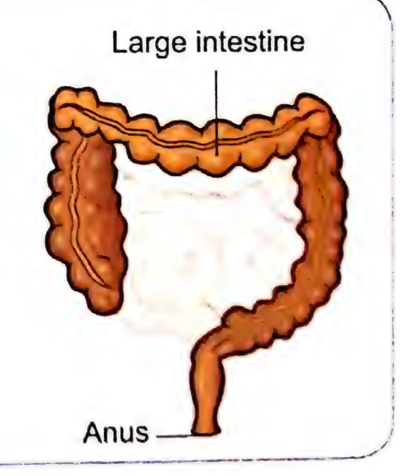
- It is a long, winding tube as its length is more than six meters.
- Food is broken down into simple nutrients in the small intestine, where :
  - Pancreas and liver secrete juices that flow into the small intestine.
  - These juices help in breaking down the food into nutrients (or digested food).
  - These nutrients are absorbed through the wall of the small intestine as they enter into tiny blood vessels and reach the blood.
  - The blood carries the nutrients to all parts of the body.

- Its function :

- It completes the digestion of different types of food.
- It absorbs the nutrients (digested food).

- The body does not benefit from some parts of food known as undigested materials that flow into the large intestine.

5 Large intestine



- It is a tube that starts from the end of the small intestine and ends with the anus.

- Its function :

It absorbs water from the undigested materials, so they become solid wastes that come out through the anus.

- Discuss with your child the functions of the small intestine and the large intestine.

? What happens when ... ?

One of the organs of the digestive system is absent.

The digestive system will not perform its function properly if one of its organs doesn't exist.

How can you keep the digestive system healthy ?

1. Chew the food well.



2. Don't eat much fast meals.



3. Drink a lot amount of water.



4. Practice sports regularly.



Check your understanding

▸ Put each of the following words in front of its suitable sentence :

(Teeth – Esophagus – Stomach – Saliva – Small intestine – Tongue – Large intestine)

1. It mixes food with acid and digestive juices. ( )
2. It changes starch into sugar. ( )
3. It absorbs water from the undigested materials. ( )
4. It completes the digestion of different types of food. ( )
5. They break down and crush food during chewing. ( )
6. It mixes food with saliva. ( )
7. It moves the food down into the stomach. ( )

Notes for parents

- Discuss with your child how we can keep the digestive system healthy.

Activity 10

Body Systems

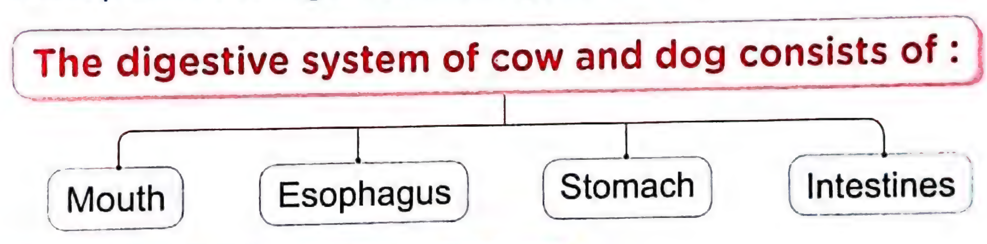
▸ **From the previous activity, we can conclude the general function of the digestive system :**

- Extracting nutrients from the food we eat.
- Digestion of food and its absorption to obtain the needed energy.

• Like human, animals need to get nutrients and energy from food they eat.

• The digestive systems of dogs and cows are alike in some ways and similar to the human digestive system, where each of them starts at the mouth and ends at the anus to obtain and absorb nutrients from food.

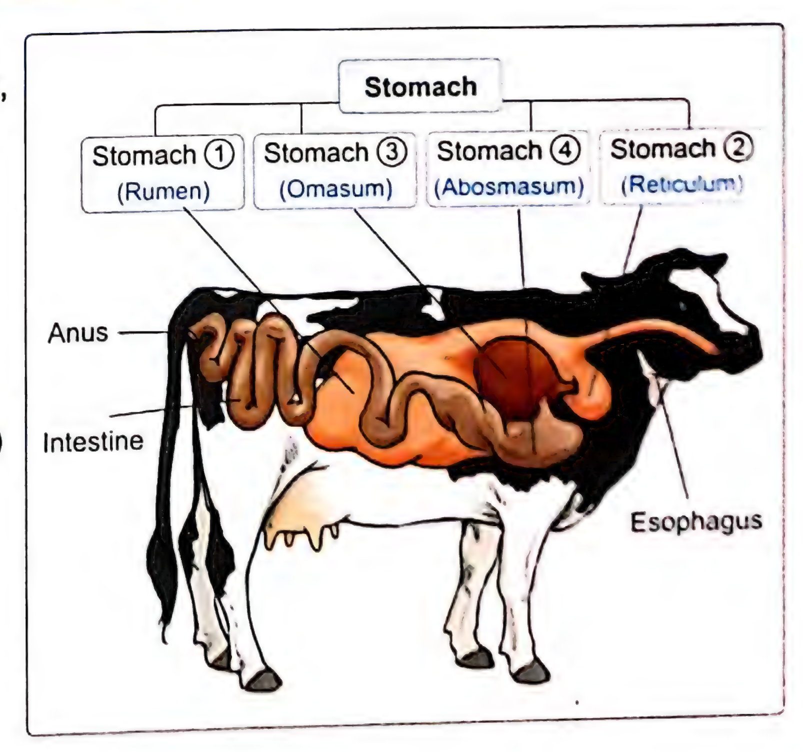
• But, there are some differences in the structure of the digestive systems of humans, cows and dogs because the digestive systems of some animals have structural adaptations to digest different types of food.



Adaptation of the digestive system of cow

• Cow eats grass.

• Grass is very difficult to be digested, so cow has a long digestive system and also some organs of its digestive system are adapted to digest this type of food such as :



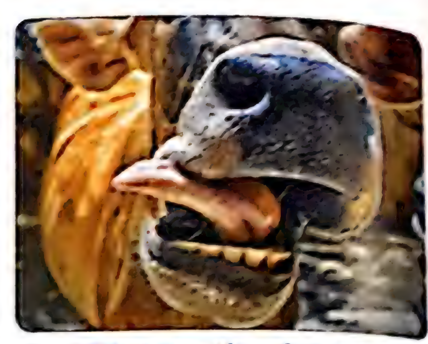
Stomach

- Cow is characterized by having four stomach-like organs (compartments) which are :
  - Stomach ① [Rumen]
  - Stomach ② [Reticulum]
  - Stomach ③ [Omasum]
  - Stomach ④ [Abosmasum]

• Let your child think about the similarities and differences between the digestive systems of humans, cows and dogs.

Teeth

Cow has flat teeth that are suitable for eating grass.



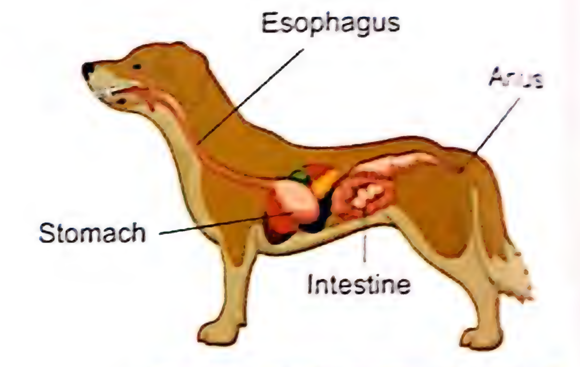
Flat teeth of cow

What happens if ... ?

A cow's digestive system is not adapted to eat grass.

The cow will start for searching for another food source to survive.

Adaptation of the digestive system of dog



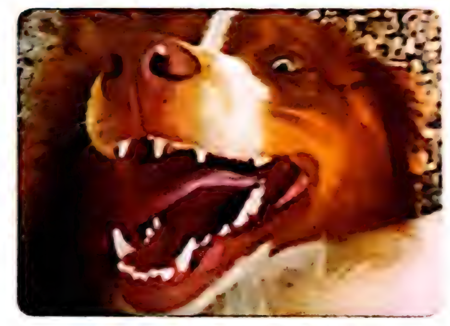
- Dog eats meat.
- Meat is much easier to be digested, so dog has a short digestive system and also some organs of its digestive system are adapted to digest this type of food such as :

Stomach

Dog has only one stomach.

Teeth

Dog has sharp teeth that are suitable for eating meat.



Sharp teeth of dog

Check your understanding

▸ Complete :

Dogs have .... teeth that are suitable for eating meat, while cows have .... teeth that are suitable for eating grass.

▸ Give a reason for :

Cow has a long digestive system with four stomach-like organs.

....

▸ What happens if ... ?

One of the organs of the digestive system of dog is absent.

....

Notes for parents

- Discuss with your child the adaptation of the digestive system of cow and dog.
- Let your child answer the question to check his/her understanding.

Activity 11

Respiratory System

▸ **Have you ever noticed that :**

During sitting, your breath slows down





During running your breath quickens



- Like getting nutrients from food, getting oxygen gas from the air is a complex process that depends on many organs working together to get the needed energy.
- Any living organism respires to get oxygen gas which is necessary to burn the digested food to get the needed energy for all the body activities, so :
  - The respiratory system is the system responsible for breathing (respiration).
  - The respiratory system supplies the body with oxygen gas and gets rid of carbon dioxide gas through the respiration process.



Respiration process :

It is a process of entering the air carrying oxygen into the body and pushing the air carrying carbon dioxide out of the body.

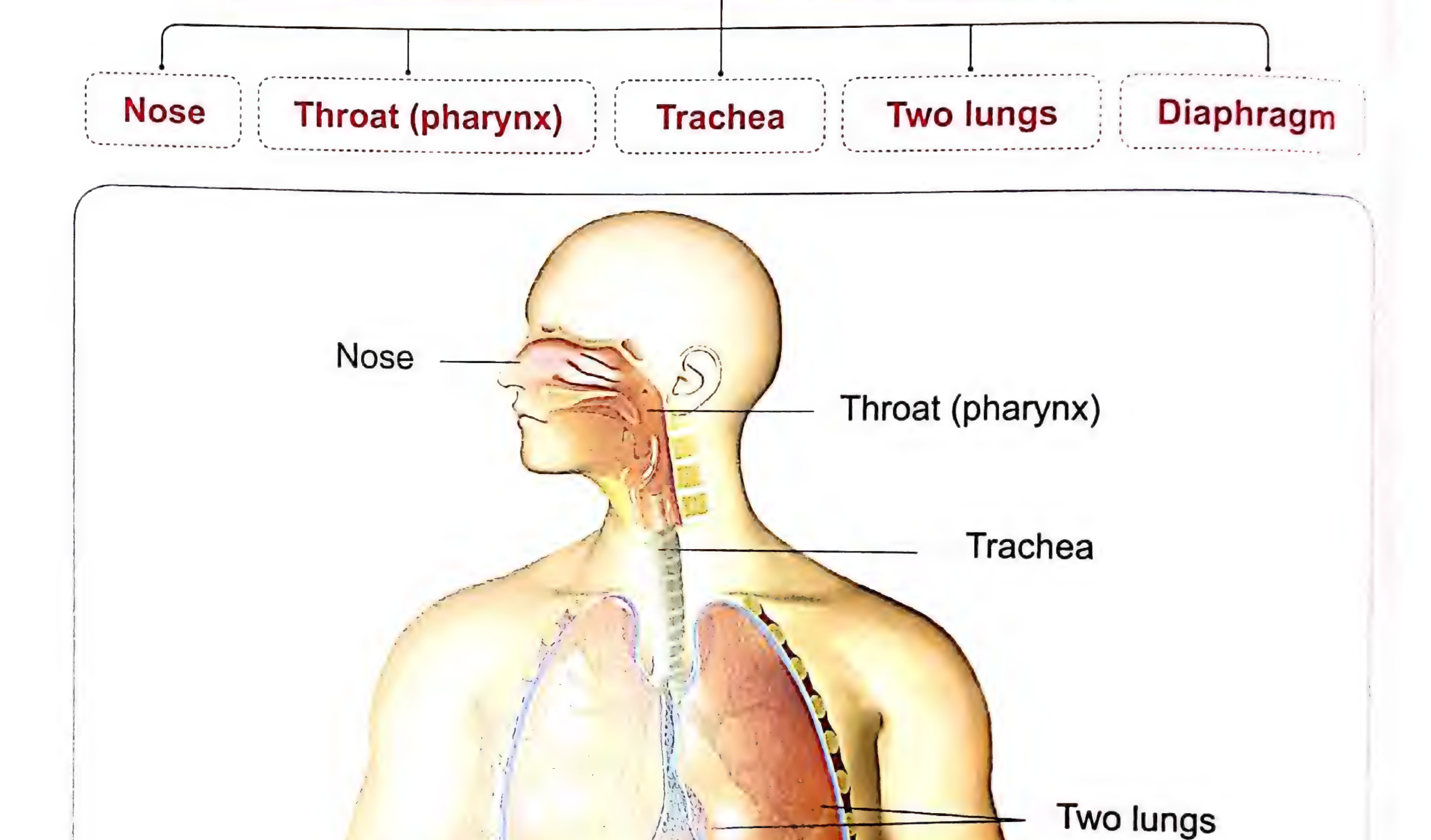
• Discuss with your child the relation between the digestive system and the respiratory system to obtain energy.

Human respiratory system

The structure of the human respiratory system :

The human respiratory system consists of some organs

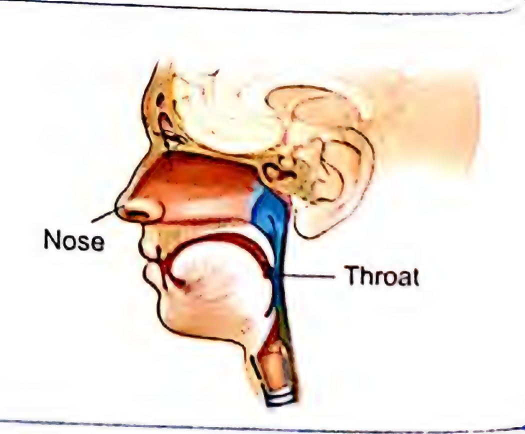
- Nose
- Throat (pharynx)
- Trachea
- Two lungs
- Diaphragm



The human respiratory system

How does the respiratory system work ?

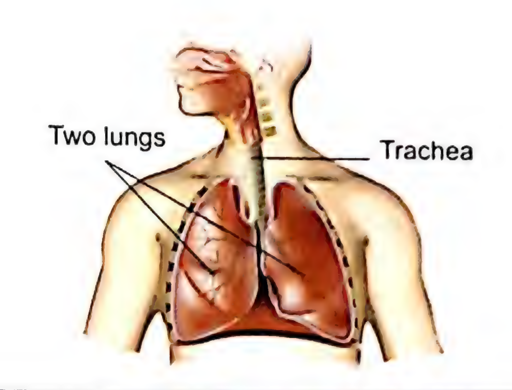
During breathing in (inhalation) , air enters through the nose and mouth then down the throat.



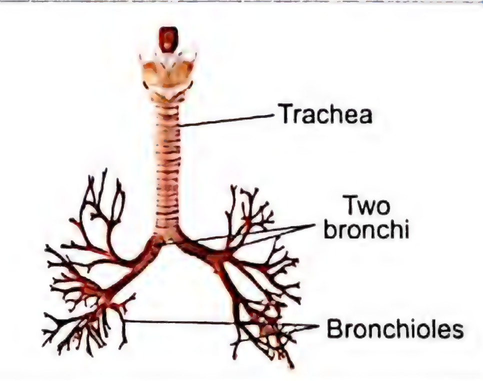
Notes for parents

- Help your child to identify the organs of the respiratory system.

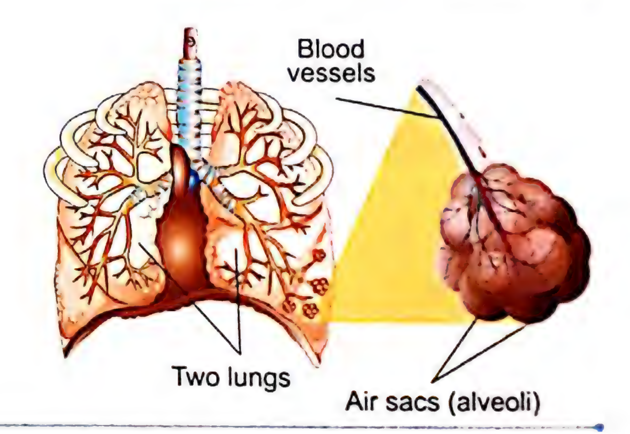
Then, the air passes through the trachea into the two lungs which fill up with air like two balloons.



Inside the lungs, the trachea is branched into two tubes known as "two bronchi" that in turn divided into smaller and smaller tubes that look like the branches of a tree known as "bronchioles".



- At the ends of these tubes there are little sacs surrounded by blood vessels known as "air sacs" or "alveoli" that extract oxygen gas from the air.
- Inside the blood vessels, oxygen moves into the blood stream, then it can be carried around the body to help other organs and systems to work.



Notes

- Our bodies need oxygen in order to do their functions.
- We get oxygen gas from the air around us all the time.
- We cannot store extra oxygen in our bodies, so we must constantly take in new oxygen.

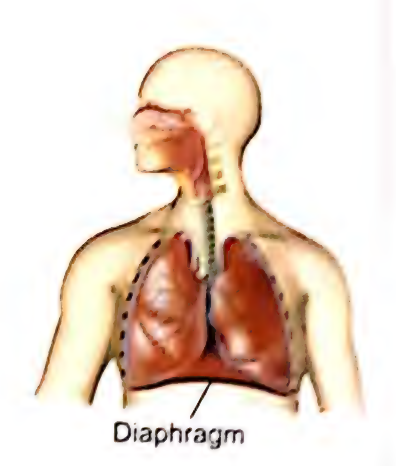
Explain ?

How does the respiratory system get oxygen to the body cells ?

Oxygen enters the lungs during inhalation, then the blood transfers oxygen to all the body cells.

- Discuss with your child how the respiratory system works.

How does the respiration process take place ?



Respiration process includes :

1. Inhalation (breathe in).
2. Exhalation (breathe out).

Inhalation and exhalation are directed by a large muscle at the base of the ribs called the diaphragm.

Comparison between inhalation and exhalation :

During inhalation	During exhalation
Size of chest increases (enlarges) Diphragm contracts	Size of chest decreases (becomes narrow) Diphragm relaxes
Diaphragm muscle	
The diaphragm contracts (shrinks) and moves downward.	*The diaphragm relaxes (expands) and moves upward.*
Size of chest	
The size of chest increases (enlarges).	*The size of chest decreases (becomes narrow).*
Type of air	
The air rich in oxygen gas enters the lungs.	*The air rich in carbon dioxide gas is expelled out of the lungs.*

Notes for parents

- Discuss with your child how the respiration process takes place.



Note

Carbon dioxide gas which is produced during respiration process is a waste product. This gas is harmful to our bodies so, we must expel it out during exhalation.

G.R.

We can't hold our breath for a very long time.

Because we can't inhale oxygen and expel out carbon dioxide so, the body can't perform its vital processes.

How can you keep the respiratory system healthy ?

1. Breathing clean air.



2. Eat fruits rich in vitamin (C) such as orange and guava.



3. Avoid smoking and smoking areas.



Check your understanding

▸ Put (✓) or (✗) :

1. During inhalation, the diaphragm muscle relaxes and moves downward. ( )
2. Respiration process is the process by which the human obtains energy from burning of the digested food. ( )

▸ Complete the following statements :

1. Respiration process includes .... and ....
2. Respiration process is a process of entering the air carrying .... into the body and pushing the air carrying .... out of the body.

In the Exercises Book :

Try to answer :

- Exercises on Lesson (4) p. 24
- Self-Assessment (4)

• Discuss with your child how we can keep the respiratory system healthy.

Lesson 5

Activity 12

How Fish Breathe

- Can you stay and breathe under water all the time ?



- Can fish stay and breathe under water all the time ?



- Human can breathe and survive on land but not under the water, while fish can breathe and survive under water but not on land.
- **Now,** we will study how fish have adapted to live under water.

Adaptation of fish to breathe under water :

- Fish have **gills** to breathe instead of the lungs in human.
- Gills are found on the sides of a fish's head, under bony flaps that have the ability to open and close.
- Water enters the mouth of the fish and passes across the gills, then blood vessels in the gills carry oxygen gas to the rest of the body.



- Fish use gills to take oxygen gas out of the water and release carbon dioxide gas.
- **So,** gills are unique structural adaptations that allow fish to live and breathe under water.

Notes for parents

- Discuss with your child the adaptation of fish to breathe under water.

Note

Water pollution impacts the fish that live nearby so, fish need clean water to survive, as we need to breathe clean air to stay healthy.

Check your understanding

▸ **Compare between the human respiratory system and the fish respiratory system using these words :**

(carbon dioxide - blood - oxygen - air - lungs - water - gills)

Points of comparison	The human respiratory system	The fish respiratory system
Similarities :	- Inhale .... gas. - Exhale .... gas. - .... carry oxygen gas to all the body parts.	
Differences :	- Humans have .... to inhale oxygen gas from	- Fish have .... to inhale oxygen gas from ....

▸ **Put (✓) or (✗) :**

1. The importance of gills to fish is like that of lungs to human. (   )
2. Oxygen gas reaches all the parts of the fish body through the blood vessels present in its gills. (   )
3. Carbon dioxide gas is harmful for both fish and human. (   )

• Let your child answer the questions to check his/her understanding.

Activity 13

Humans Change the Environment

- You have studied multiple plant and animal adaptations to various environments.

▸ **What happens as these environments continue to change ?**

- If change occurs **slowly**, organisms have time to adapt over many generations.
- Human activity often rapidly changes ecosystems over days or years and these **rapid** changes can cause many organisms to move, disappear, die or even become extinct (extinct means that a living organism is no longer exist on Earth).
- Organisms are adapted to the ecosystems in which they live, however that ecosystem may change.

▸ **Some of ecosystem changes are caused by the nature itself, such as :**



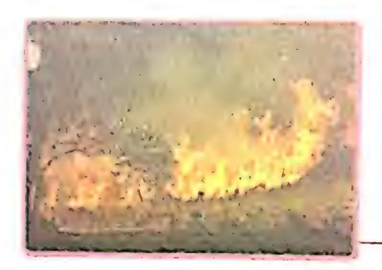
Change in temperature.



The amount of rainfall from seasons.



Severe weather events, such as winds.



Wildfires and floods change the nature of plants that are available for food causing increases or decreases in predators and prey populations.

Humans change the environment

▸ **Now, we will study :**

1. Evidence that human activity contributes to rapid changes in an ecosystem.
2. The impacts that human activities have on plants, animals and humans themselves.

Notes for parents

- Discuss with your child some of the ecosystem changes that caused by the nature itself.

1 Evidence that human activity contributes to rapid changes in an ecosystem :

▸ Some of ecosystem changes are caused by the human activity, such as :



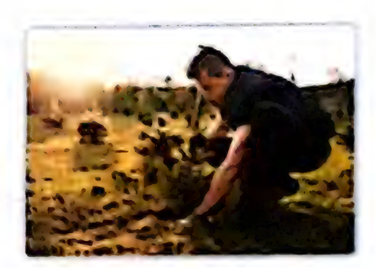
Cutting down forests.





Plowing grasslands.

Introducing plants, animals and diseases that were never part of the ecosystem.





The exhausts from cars and some factories cause **air pollution**.

Bad habits, such as throwing waste materials in waterways cause **water pollution**.





Watering the soil with polluted water causes **soil pollution**.

2 The impacts that human activities have on plants, animals and humans themselves :

- **Plants and animals are affected by changes in an ecosystem caused by humans when air, water and soil get polluted, where :**
  - Some animals can survive by moving to another ecosystem to find what they need.
  - Plants depend on their seeds to land in a better place for them to survive and grow.

- Discuss with your child the evidence that human activity contributes to rapid changes in an ecosystem.

- **Humans are also affected by changes in an ecosystem, where :**
  - Air pollution (smog) makes the human hard to breathe.
  - Water pollution makes the human hard to find clean drinking water.
  - Air, water and soil pollution make the crops cannot grow.

Note

People who live in cities where air pollution is a big problem are forced to change their lifestyle on days when the pollution levels are dangerous, because exposure to high levels of air pollution over a long period of time can **damage the lungs** and cause **asthma** and **heart problems**.



The role of human to help restore ecosystem :

- As humans can cause harmful changes, **they can help restore their** ecosystems by :
  - Replanting the cleared forests.
  - Removing the pollutants of air and water.
  - Preserving plants and animals in these ecosystems.

Note

Plants and animals that live in an ecosystem may have to change their behaviors in order to survive, this is due to the human activities that change the ecosystem.
So, plants and animals may undergo structural and behavioral adaptations in response to change in the ecosystem.

Check your understanding

▶ Put (✓) or (✗) :

1. Wildfires and floods cause changes in some properties of an ecosystem. ( )
2. Water pollution affects fish, but doesn't affect humans and plants. ( )
3. Humans must keep air, water and soil clean. ( )

Notes for parents

- Discuss with your child the impacts that human activities have on plants, animals and humans themselves.

Activity 14

Record Evidence Like A Scientist

You have learned a lot about how different types of adaptations help plants and animals survive.

In this activity, which will be repeated at the end of each concept, we will learn how to think like scientists to answer a question about one of the main points of this concept through four main steps :

- **Step 1 : The Question.**
- **Step 2 : My Hypothesis (Claim).**
- **Step 3 : My Evidence.**
- **Step 4 : My Scientific Explanation.**

? Step 1 The Question

How do different types of animals and plants adapt to survive in extreme climate ?

Step 2 My Hypothesis (Claim)

Animals and plants have the ability to change their body structure and behaviors to adapt the extreme climate in their environment.

Note

Your hypothesis should be formed of a sentence that gives an answer for the previous question in step 1.

Step 3 My Evidence

- **Examples of structural adaptations :**
  - Some animals have thick fur to keep their bodies warm, while some other animals have extra-long ears to keep their bodies cool.
  - Some plants have tiny leaves to hold in water.
- **Examples of behavioral adaptations :**
  - Some animals stay in burrows to keep their bodies warm or cool.

Note

You should mention enough and suitable evidence that support your hypothesis.

• Help your child to think like a scientist by answering a question about one of the main points of this concept then write his/her hypothesis and evidence.

Step 4 My Scientific Explanation

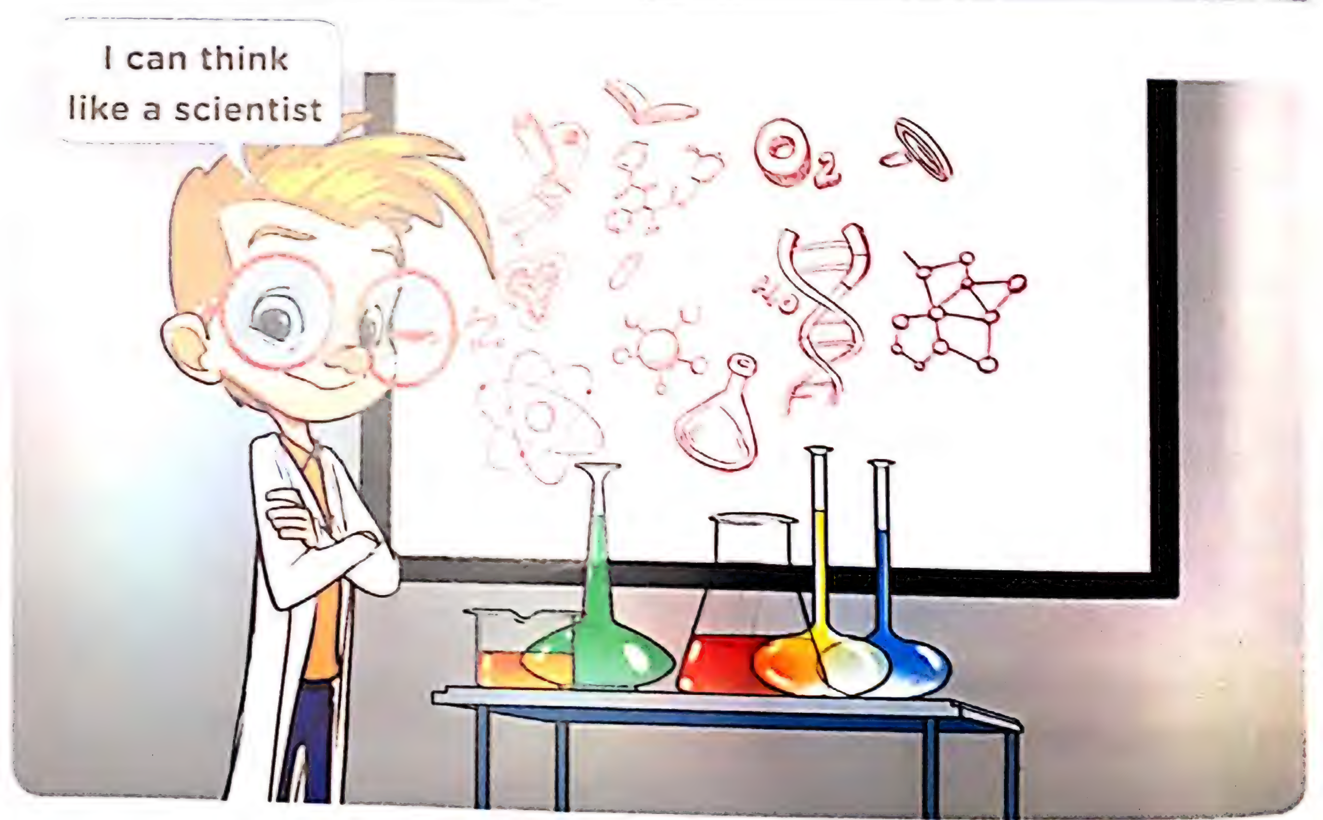
Animals and plants can survive in extreme climate through structural and behavioral adaptations, where :

- The structural adaptation in the polar bears that have thick fur and penguins that have a layer of fat to adapt the cold climate in polar regions.
- The structural adaptation in fennec foxes that have extra-long ears and also the behavioral adaptation as they stay in burrows to adapt the hot climate in desert regions.
- The structural adaptation in acacia trees that have tiny leaves to hold in water to adapt hot climate in savannah regions.



Note

Your scientific explanation should explain your hypothesis and evidence introducing some supportive examples from what you have learned.



In the Exercises Book :
Try to answer :
- Exercises on Lesson (5) p. 33
- Self-Assessment (5)

Notes for parents

- Help your child to think like a scientist by writing his/her scientific explanations as the final step.

Lesson 6

Activity 15



▸ **Observe these pictures, then put ✓ or ✗ in front of each of the following sentences :**







- Frogs, humans and fish have the same organs to take in oxygen from air or water. ( )
- Humans, frogs and fish all can live on land. ( )

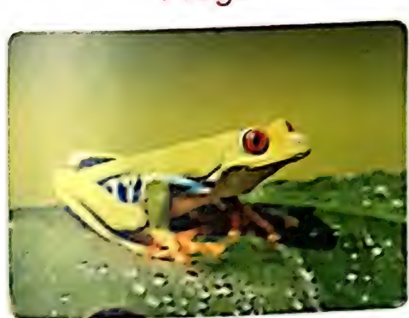
Careers and adaptation

- Scientists can learn how different organisms adapt to their environments through researches and use this knowledge to help **endangered species** survive.
- Amphibians are one of the most amazing living organisms on Earth.
- Now, let's study some facts about amphibians.

Amphibians

- They are small animals such as :

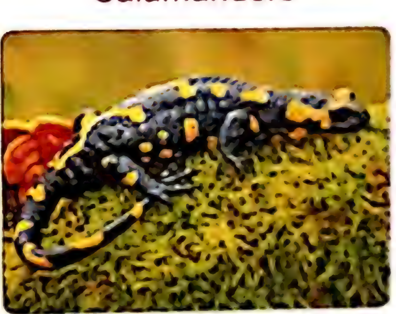
Frogs



Toads



Salamanders



- They can live in moist environments like rainforests, stream and ponds.
- They need water as human to survive but in a different way.
- Like humans, adult amphibians can breathe using lungs when they are on land, but they can also take in oxygen from water.

• Let your child determine a problem that occurs in the environment and choose the best solution for this problem.

How amphibians get oxygen from water ?

- Amphibians are covered with skin that allows water and gases to pass through.
- Water surrounds the skin of amphibians, making their skin moist, so they can absorb (extract) oxygen directly from water.
- This structural adaptation makes amphibians well-suited to live in wet environments.



Golden frog

The role of scientists to protect many types of frogs from extinction

- **Frogs need clean water to stay healthy because they are very sensitive to the effects of :**
- Water and air pollution.
- Destroying the natural environment.
- Viruses that can travel through water.
- **Scientists are working to save many types of amphibians from extinction like golden frogs in rainforests by studying :**
- How these animals interact with their environments.
- What make these animals sick in their environments.
- The reasons of the disappearance of these animals around the world at frightening rates.

Note

Ninety species of amphibians have become extinct in the last 20 years in addition to 124 other endangered species.

Notes for parents

- Let your child think about what scientists can do to protect many types of frogs from extinction.

Protection (Advocate) of amphibians from extinction

Biologists have a great role in protecting amphibians from extinction. Although, all people should think about how to protect amphibians from extinction as follows :

For biologists

Understanding how amphibians breathe in air and water helps scientists search for pollution factors that threaten them in air and water.

For people

Clean air and water is important for amphibians, so people should :

- Avoid throwing waste materials in water.
- Dispose of chemicals in a correct way helps to avoid water pollution.

Check your understanding

▶ **In your opinion, which of these sentences is correct and which one is incorrect to protect amphibians from pollution that may cause extinction.**

The sentences	correct (✔)	incorrect (✗)
• Cutting down trees to use their wood to make furniture.		
• Throwing chemicals into the water.		
• Operating factories in proper ways to decrease the amount of smog.		
• Avoid throwing wastes into the water.		

In the Exercises Book :
Try to answer :
• Exercises on Lesson (6) p 39
• Self-Assessment (6)
• Model Exam on Concept (1.1)

• Let your child answer the question to check his/her understanding.

Activity 16

Review : Adaptation and Survival

▸ **We can summarize this concept in the following main points :**

Adaptation :

It is a characteristic of living organisms that allows them to change over generations and helps them to survive and reproduce in the ecosystem.

Types of adaptation

1. **Structural adaptation :**

It is a change in the structure of the animal's body to adapt its environment.

Example : The blood vessels in the penguin's feet.

2. **Behavioral adaptation :**

It is a change in the behaviors or acts of a group of animals to adapt its environment.

Example : Desert lizard looks for shade during hot sunny days.

Camouflage :

It is an example of adaptation in which some animals hide from their predators or their preys by hiding in different environments.

Examples of some animals that make adaptation to survive in their environments through camouflage :

1. Polar bear.
2. Brown bear and dark bear.
3. Caracal and fennec fox.
4. Some types of lizards.

Plants can make adaptation to survive in their environments such as :

- Acacia tree in savannah forest has a very long taproot that grows directly downward to search for water below the soil surface.
- Kapok tree in Amazon rainforest of Brazil has buttress roots that are not planted deeply in the ground, but they grow high up on its trunk to hold the tree firmely in the soggy soil.

Digestive system :

It is the system responsible for breaking down food into small parts to enable the body cells to use them in getting energy.

- Digestive system is adapted to meet the needs of living organisms according to the type of food that they eat.

Notes for parents

- Help your child review the main points in this concept

Digestive system of human consists of :

1. Mouth.
2. Esophagus.
3. Stomach.
4. Small intestine.
5. Large intestine.

Digestive system of dogs and cows consists of :

1. Mouth.
2. Esophagus.
3. Stomach.
4. Intestines.

- Cows eat grass, while dogs eat meat.
- Digestive system of a cow has four stomach-like organs, while that of a dog has one stomach.
- Cow has flat teeth, while dog has sharp teeth.

Digestion process :

It is the process of breaking down food and changing it into chemical substances that the body absorbs and uses them in getting energy and growth.

- **Respiratory system** is the system responsible for breathing.

Respiratory system of human consists of :

1. Nose.
2. Throat (pharynx).
3. Trachea.
4. Two lungs.
5. Diaphragm.

Respiration process :

It is a process of entering the air carrying oxygen into the body and pushing the air carrying carbon dioxide out of the body.

Respiration process includes :

1. Inhalation.
2. Exhalation.

- Living organisms breathe in oxygen gas and breathe out carbon dioxide gas.
- Humans have lungs to inhale oxygen gas from air to adapt to live on land.
- Fish have gills to inhale oxygen gas from water to adapt to live underwater.
- Amphibians respire through lungs and skin to adapt to live on land and in water.
- We have to keep air, water and soil clear, in order to protect living organisms from extinction.

Concept 1.2

Senses at Work





By the end of this concept, your child will be able to :

- Develop models illustrating how animals receive, process and react to information in their environments.
- Explain how organs and systems work together to process and response to the senses.
- Plan and carry out investigations to produce evidence that the senses play a role in reaction time.



- Brain
- Environment
- Information
- Receptors
- Senses
- Stimuli
- Ear
- Heart
- Nerves
- Reflex
- Sound
- Tongue

Lesson 1

Activity 1

Can You Explain?



- Can you notice how the above living organisms receive stimuli from their surrounding environments (such as, feeling hungry - thirsty - running away from enemies - cold... etc.) **as well as how they are responding to them?**
- Humans can listen to music through the organ of hearing, which is the ears.
- Owls have extraordinery senses of hearing and sight to be able to find their preys in the dark.
- Dogs have very sharp senses of hearing and smell, therefore they are used in guarding.
- The Egyptian mongoose makes sounds that spread information to other mongooses to move from one place to another or when searching for food.

From the previous explanation it is clear that :
Animals have senses like humans however, some animals have sharper sense of hearing or sight, or their strength lies in some other senses that enable them to communicate with each other using sounds or movements, so that they are able to adapt to their surrounding environments and can survive.

In this concept, we are going to study :

- Dolphin super senses.
- Super senses of some animals.
- How the five senses work.
- The nervous system and how it works.

Notes for parents

- Explain to your child how humans and animals gather information from the environments by using their senses.

Activity 2

Dolphin Super Senses

- Hearing is one of the most important senses for all of us.
- Our sense of hearing allows us to gather information about the world around us.

Strength of hearing

	Strength of hearing (0–180 scale)
Humans	
Dogs	
Dolphins	

- **Look at the opposite graph, and then answer the following the question:**

Do the living organisms in the graph have similar hearing senses?

Yes No

- Dolphins have super senses that help them:
  - survive.
  - search for food.
  - protect themselves under water.
- The most sharp sense that dolphins have is the **sense of hearing**, since they can hear all sound tones.

How can dolphins locate organisms and other things under water ?

- Dolphins use a property known as **"echolocation"** that depends on **"echo"** to detect the location of other living organisms and objects in the water.

Echo:

It is the reflection (bouncing off) of sound waves back from a solid surface to its source.

- **Let's see how dolphin use echolocation property :**

1. Sound produced by dolphins travels in the form of waves called sound waves.
2. These waves travel through water, and when they hit objects,they bounce back to dolphins in the form of echo.
3. Echo helps dolphins locate their preys.





Check your understanding

- **Put (✓) or (✗):**

1. Smell is one of the super senses of dolphins. (   )
2. Echo helps dolphins locate their preys. (   )

- Discuss with your child how dolphins use the echolocation property to locate their preys and other objects under water.

Activity 3

Using our Five Senses

▶ **Look at the following pictures, then write under each picture the sense that helps each person collects information from the surrounding environment** Using the word bank below (You can write more than one sense under each picture).

Word bank Hearing – Sight – Taste – Smell – Touch

1. Watching TV



....

2. Eating Pizza



....

3. Listening to music



....

4. Holding a piece of ice



....

Notes for parents

- Help your child to write the sense which is responsible for each activity shown in the pictures.

Activity 4

What Do You Already Know About Senses at Work ?

Animals perceptions :

- You have previously known that animals have senses like those of humans, and each animal can use more than one sense for more than one purpose to be able to adapt to its habitat, as illustrated by the following examples :

Animal	Purpose	Sense	Example
Fox	Avoiding danger	Hearing – Sight	A fox uses its eyes and ears to runaway from its enemies,when seeing or hearing them.
Chameleon	Searching for food	Sight – Taste	A chameleon uses its eyes and tongue to see and taste its food.
Dog	Recognizing friends	Smell – Sight	By smelling human scent.
Monkey	Identifying things	Touch – Smell – Sight – Taste – Hearing	A monkey uses its five senses to distinguish between things it eats or risks it faces.

• Discuss with your child that animals can use more than one sense for more than one purpose.



▸ Fill in the following table using the information you have learnt from the previous table (you can write more than one sense).

Animal	Purpose	Sense
	Searching for food	....
	Avoiding danger	....
	Recognizing its friends	....

In the Exercises Book :
Try to answer :
- Exercises on Lesson (1) p. 48
- Self-Assessment (7)

Notes for parents

- Let your child answer the questions to check his/her understanding

Lesson 2

Activity 5

Super Sensory Organs

▸ **Look at the following pictures and then answer the opposite questions :**

• Can a human see everything clearly inside a dark room?

Yes No



• Can an owl see its prey in the dark during nighttime ?

Yes No



▸ **Have you ever had trouble seeing at night ?**

- You can hear the noise of something small moving through the darkness, but you cannot see it clearly to.
- Some animals can look for their food at night using their super senses, these animals that become active at night are known as " **Nocturnal Animals** ".

▸ **Why some animals become active at night ?**

1. In extremely hot regions, the perfect time to look for food is during the nighttime, when the weather becomes cool enough.
2. Some animals hunt at night, because their preys are available at night only.
3. Some animals depend on total darkness to hide from their preys and surprise them.

▸ **How can nocturnal animals hunt at night without the need of light ?**

- The super sensory adaptations of nocturnal animals allow them to navigate and search for food safely in the dark, as shown in the following examples :

• Discuss with your child why nocturnal animals are active during the nighttime

1. Snake Super Sensory Adaptations :



Snakes cannot see at night, but they have the ability to sense heat using a special body part in their faces.

Purpose :
To locate their preys at night through sensing their body heat.

2. Bat Super Sensory Adaptations :



Bats cannot see very well in the dark, but they are able to use echolocation property (like dolphins) using sound waves to find their food in the dark using their hearing sense.

Purpose :
To locate their preys (as insects) and other bodies in their surroundings in the dark using the echo.

3. Owl Super Sensory Adaptations :



- Owls have both extraordinary eyesight and hearing.
- The bowl-shaped faces and feathers in owls' heads help them detect, amplify and direct distant sounds directly into their ears.
- When animals making the noise are hiding within grass or under snow, the strong hearing sense of the owl allow it to detect their slight and faraway movements.
- Owls can rotate their heads in all directions, so that they can search for preys everywhere.

Purpose :
To detect the movements and sounds of tiny faraway preys.



Give a reason for :

- **Bats can catch insects during the night.**

....

Notes for parents

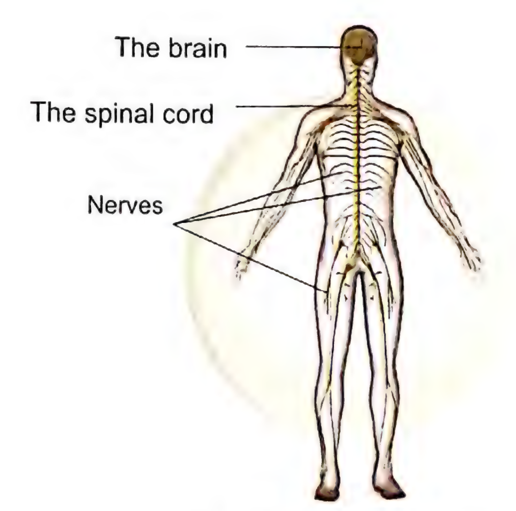
- Discuss with your child how some nocturnal animals can hunt their preys in the dark during the nighttime.

Activity 6

The Nervous System

▸ How do humans use their senses to gather information from their surroundings ?

- There is integrity between the five senses of the human body and the nervous system, such that these senses are considered a part of the nervous system, and they work integrally with the other body systems.
- Mammals such as human, elephant and dog have the same structure of nervous system.



Human nervous systems



The nervous system consist of :

1 **Brain :**

The main control center of the body.



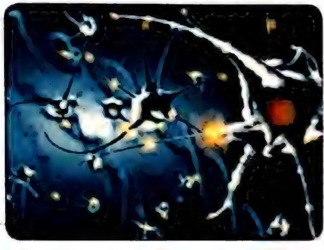
2 **Spinal cord :**

Carries messages from the brain to the body and from the body to the brain.



3 **Nerves :**

Carry messages from the brain to the spinal cord and other parts of the body, as well as from other parts of the body to the spinal cord and the brain.



How do information from the senses reach the brain to be processed ?

- The brain is connected to a group of nerves known as **the spinal cord** that passes through the backbone.
- The spinal cord branches to smaller and smaller nerves which are distributed throughout all parts of the body.
- Some of these nerves are directly connected to the brain, such as the nerves of **the eyes and the heart.**

- Discuss with your child the structure of the nervous system in mammals.
- Explain to your child that mammals are the animals that give birth and don't lay eggs.

- The sensory organs (eyes – nose – ears – tongue – skin) receive information from the environment.
- The nerves spread across the whole body connect the sensory organs with the brain.
- The nerves transmit information from the sensory organs to the brain in the form of **electrical impulses**.

Note

The sensory organs (eyes – ears – nose – tongue – skin) contain a special type of nerves known as sensory receptors.

Sensory receptors :

They are nerves found in different places of the body, and they are responsible for receiving information from the surroundings.

The nervous system and pizza

- How does the human body respond to an external stimulus like the smell of pizza?



Whenever you smell something such as pizza, you receive that information through the sensory receptors in your nose.



Then the sensory receptors of smell that are found in the back of your nose send a specific signals along the nerves to your brain. These signals are in the form of electrical impulses.

Once the smell information reaches your brain, it is processed by the brain to produce the proper response, such as determining the type of the food.

Note

The memory in your brain plays a role in responding to the pizza smell, whereas the memory sends signals clarifying that the pizza smell is related to food.

Notes for parents

- Explain to your child how the nervous system works.



Choose the correct answer :

- Imagine that you are touching an ice cube with your finger, do you know where the information is processed to tell you that it is cold ? ....

a. In your finger. b. Hand. c. Nerve.

d. Brain. e. Spinal cord.

Complete :

1. The nervous system of mammals is composed of .... and ....
2. Nerves of .... and .... are considered examples of the nerves directly connected to the brain.
3. The spinal cord passes through ....

Optional Digital Activity

Activity (7) " **Processing Sensory Information** " in the school book is an optional digital activity. You can do this activity by scanning its QR code found in your school book.

In the Exercises Book :

Try to answer :

- Exercises on Lesson (2) p. 50
- Self-Assessment (8)

• Let your child answer the questions to check his/her understanding.

Lesson 3

Activity 8

Sensing of the Environment

▸ **Look at the following pictures, then choose the correct answer :**



- When your hand touches the spines of a cactus plant, it is quickly withdrawn in less than one second.



- When this small animal hears a snake moving nearby, it jumps quickly in less than one second.

- **Which system in the human and animal bodies do you expect is responsible for movement in such situations?**

  a. Respiratory system. b. Nervous system. c. Digestive system.

Avoiding danger in humans and animals :

- The different parts of the nervous system (sensory receptors, nerves, spinal cord and brain) are responsible for sensation and delivering messages.
- In human the reason for a response of danger is different from the reason for a response of danger in animals, where :
  - Humans do not have to run away from dangerous wild animals, meanwhile the human body responds by quickly moving away from the threat for safety.
  - Animals searching for food could mean the fear of being a prey to other animals, that is why all their senses and body systems are working integrally for an effective adaptation to the environment, so that they can survive.

Notes for parents

- Discuss with your child the difference between humans and animals in avoiding danger.

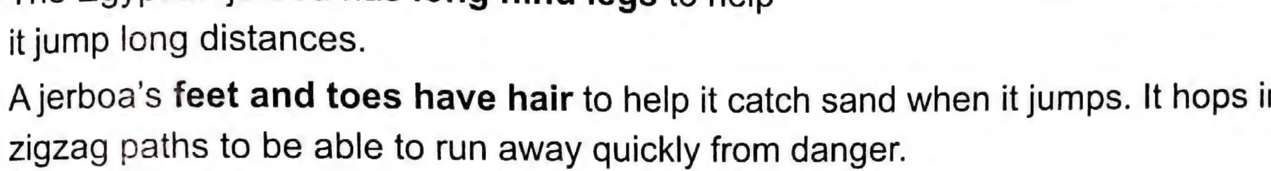
Jumping Jerboa :

The Egyptian jerboa is a species of desert rodents. It is a tiny animal with very large ears, small eyes and long hind legs.

Egyptian jerboa

Adaptation to the Environment :

- The Egyptian jerboa has **long hind legs** to help it jump long distances.



- A jerboa's **feet and toes have hair** to help it catch sand when it jumps. It hops in zigzag paths to be able to run away quickly from danger.
- A jerboa has **large ears**, so that it can hear snakes, even if they are small.

▶ **How do all parts of a jerboa's body work together to avoid danger?**

When snakes make noise as they approach a jerboa :

1. The sensory receptors in a jerboa's ears send a message through a network of nerves to the brain.
2. The jerboa's brain then translates this message and responds by alerting its legs to start moving.
3. The jerboa's strong hopping legs starts to jump away from the danger in zigzag paths .

- **The above explanation shows that what helps a jerboa to survive are:** The way its senses work (e.g.: sharp hearing), the structure of its adaptive body (strong hopping hind legs), and the integration of all previous with its nervous system.
- **In the above example**, the whole response process of a jerboa running away from danger occurs in less than one second. The time taken by a jerboa to react to danger is known as the "reaction time".

Reaction time :

It is the time taken by an organism's body to react to different stimuli around it.

• Explain to your child how the jumping jerboa avoid danger with the help of its nervous system.



▸ Based on your understanding of the activity:

- Clarify the super senses that were most helpful for a jerboa in sensing danger.

....

▸ Put (✓) or (✗):

1. When a jerboa feels unsafe, its brain sends messages to its legs through its nervous system to run away from danger. (   )
2. The reaction time is the time taken by a jerboa to respond to danger. (   )
3. Jerboa's hind legs are short to help it jump long distances. (   )

Optional Digital Activity

Activity (9) "**Nerves**" in the school book is an optional digital activity. You can do this activity by scanning its QR code found in your school book.

In the Exercises Book :
Try to answer :
- Exercises on Lesson (3) p. 57
- Self-Assessment (9)

Notes for parents

- Let your child answer the questions to check his/her understanding.



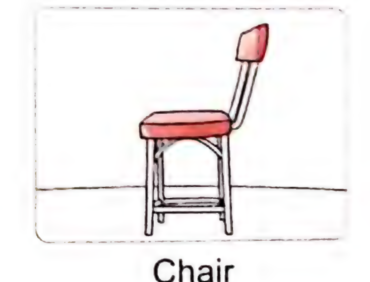
Activity 10

Reaction Time

- You have previously read about the importance of reaction time for animals like the jerboa.
- In this experiment, we are going to study the reaction times for auditory and visual stimuli to catch a stick that has fallen to the ground.
- In the first part of the experiment, you will use the sense of sight to see where the stick has fallen.
- In the second part of the experiment, you will use the sense of hearing to hear the sound from which you know that the stick has fallen.

Tools used


Stick


Chair


Stopwatch

Steps







1. One of your friends stands on a chair holding the tip of the stick, while another friend sits on the floor, such that his hand is near the end of the stick without touching it.
2. The first friend drops the stick, and the other friend will try to catch it as fast as he can, depending on his sense of sight.
3. Calculate the reaction time taken to catch the stick using the stopwatch.
4. Repeat the above steps three more times, given that the stick must be at the same height from the floor.
5. Write down your notes in a table, and then draw a circle around the average reaction time.
6. Repeat the previous steps three times, while his eyes are closed and depending on his sense of hearing, such that the person holding the stick should say the word "go" when he releases the stick, record your notes in another table, and then draw a circle around the average reaction time.

- Let your child apply this experiment to understand the meaning of reaction time
- Discuss with your child that the brain can process what we see faster that what we hear

Observation

Data table of the first part of the experiment Relying on the sense of sight.

Distance	Trial	Reaction Time
1 m	1	3 seconds
1 m	2	(2) seconds
1 m	3	1 second

Date table of the second part of the experiment Relying on the sense of hearing.

Distance	Trial	Reaction Time
1 m	1	4 seconds
1 m	2	(3) seconds
1 m	3	2 seconds

General Conclusion

• In the first part of the experiment :	When the eyes saw the stick falling, they sent a signal to the brain through the nerves. The brain processed the information and transmitted a message to the hand muscles in order to catch the stick.
• In the second part of the experiment :	When the ears heard the voice "go", they sent a signal to the brain through the nerves. The brain processed the information, and then transmitted a message, so that the hand muscles respond and catch the stick.

• You could catch the ruler faster when you saw it fall, because the brain can process what you see faster than what you hear.

Check your understanding

Put (✓) in front of the situations that illustrate the importance of reaction time :

1. You move your hands away on touching a very hot object . ( )
2. You blink your eyes when something comes near it. ( )
3. You fall while playing football. ( )

In the Exercises Book :
Try to answer :
• Exercises on Lesson (4) p. 61
• Self-Assessment (10)

Notes for parents

• Discuss with your child that, in any experiment, conducting more trials will help him/her increase the accuracy of the results.

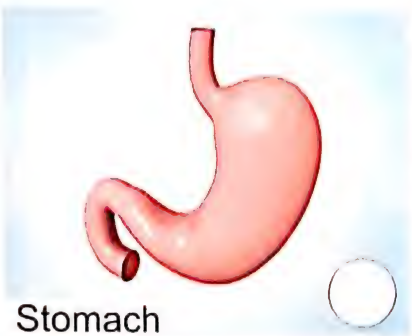


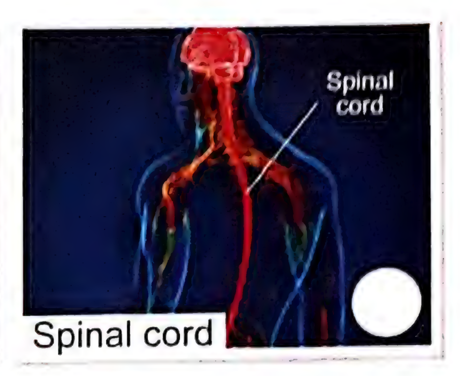
Activity 11

How the Nervous System Works

▸ **Look at the following pictures, then put (✓) in front of the picture that represents a part of the nervous system.**


Brian

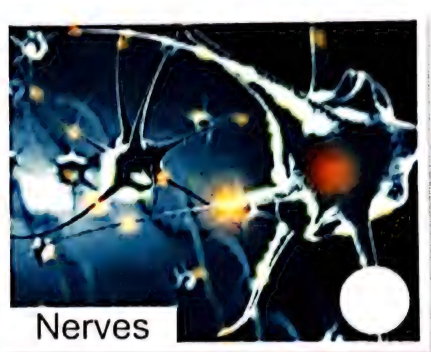

Stomach



Spinal cord


Large intestine


Lungs


Nerves

Functions of the nervous system

1. Collecting information about what happens inside and outside the body then sends these information to the brain.
2. Understanding what this information means.
3. According to this information, a signal is sent to the body telling it what to do.

▸ **What role do the senses of a living organism play in processing information?**

- The sensory organs like the eyes, ears and skin, are responsible for gathering information.
- The nervous system sends this information from the sensory organs to the brain through the nerves to be processed and interpreted.

Note

The components of the nervous system are connected together to the nerves that transmit information throughout the body parts.

• Discuss with your child the functions of the nervous system.

Example:

When your ears hear the bird chirping (sound waves).



Your ears send a message through the nerves to the brain which processes these sound waves.



Then, the brain sends a signal to the body to tell it what to do, such as turning around to search for the bird on a tree.



Notes

- Some messages, which are called reflex actions, are so fast that you cannot realise it.
- Other messages are sent from and to the brain automatically, like the signal to breathe.

Check your understanding

Complete the following sentences :

1. The components of the nervous system are connected to each other by ....
2. The sensory organs like , are responsible for gathering information.
3. The nervous system sends information via .... to .... to be processed.
4. Collecting information about what happens inside and outside the body is one of the functions of the system.

Notes for parents

- Let your child answer the questions to check his/her understanding.

Activity 12

Describing the Nervous System

▸ **From the previous activity, we conclude that:**

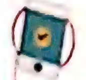
- The parts of the nervous system work together to perceive our surroundings and interpret information in order to take the right action, and then transfer signals to the body to respond to different stimuli.
- A person cannot receive, send or respond to information without the presence of all parts of the nervous system together. In other words, every part of the nervous system cannot work individually.



▸ **Complete the following sentences using these words :**

brain – nervous system – reaction time – nerves – spinal cord – electrical impulses – sensory receptors.

1. The brain is a part of the ....
2. The bundle of nerves passing through the backbone is called the
3. The nerves transmit information from the sensory organs to the brain in the form of ....
4. The .... is the time taken by an organism's body to respond to different stimuli around it.
5. The .... is considered the main control center of the body.
6. The .... are the nerves that lie in different places of the body and are responsible for receiving information from the environment.
7. The .... carry messages from the brain to the spinal cord and other parts of the body.



Optional Digital Activity

Activity (13) **"Your nervous system"** in the school book is an optional digital activity. You can do this activity by scanning its QR code found in your school book.

In the Exercises Book :
Try to answer
- Exercises on Lesson (5) p. 65
- Self-Assessment (11)
- Model Exam on Concept (1.2)

• Let your child answer the questions to check his/her understanding



Activity 14

Record Evidence Like A Scientist

You have learnt a lot about how the nervous system and the senses work together.

- Now, you are going to learn how to think like a scientist to answer a question about one of the main points of this concept through the four steps you have learnt in the previous concept.

▸ **Complete the following steps using these words below :**

brain – information – nervous – skin – echo – adapt – sensory organs – ears – electrical impulses – nerves – nose.

Step 1 The Question

How do animals receive and respond to stimuli in their habitat?

Step 2 My Hypothesis (Claim)

Animals use their .... system to receive and process information.

Step 3 My Evidence

The .... must transmit the information from the .... to the .... to be processed and perceived, since our senses cannot process information without the nervous system.

Step 4 My Scientific Explanation

- The nervous system of animals receives, transmits and processes ....
- Animals have sensory organs just as humans, including the eyes, ... , ... , tongue and ....
- When animals receive information from their habitat, it is transmitted to the nerves in the form of ....
- A signal is sent to the brain, which then sends signals to other parts of the body to respond.
- Dolphins and bats get food by identifying the prey location using the
- The sensory organs help animals .... and survive in their habitats, since if they do not have these organs, they cannot survive.



Optional Digital Activity

Activity (15) "**Become a neuroscientist**" in the school book is an optional digital activity. You can do this activity by scanning its QR code in your school book.

Notes for parents

- Help your child to complete the steps to think like a scientist by answering a question about one the main points of this concept.

Activity 16

Review : The Senses at Work

▸ **We can summarise this concept in the following main points :**

- Some animals have sharp senses to help them adapt to their habitats and survive.
- The sharpest sense in dolphins is hearing, so that a dolphin can locate its preys by using echolocation (echo).
- Some animals can look for food during the nighttime using their super senses. Such animals are called "**Nocturnal Animals**".

Examples of **nocturnal animals** :

- **A snake:** has the ability to sense the heat of its prey's body.
- **A bat :** has the ability to use echolocation to locate its preys and other different objects in the dark by hearing.
- **An owl :** - has extraordinary acute eyesight and hearing.
  - The bowl-shaped faces and feathers in owls' heads help them detect, amplify and direct distant sounds directly into their ears.
  - Owls can rotate their heads in all directions, so that they can search for preys everywhere.

- **The nervous system consists of:** the brain, spinal cord and nerves.
- **The sensory receptors:** nerves that lie in different places of the body, and are responsible for receiving information from the environment.
- **The Egyptian jerboa:** is a rodent that has large ears (sharp hearing), small eyes and long hind legs.
- **The reaction time:** is the time taken by an organism's body to react to different stimuli around it.
  - The reaction time varies based on the sense used, such that using our eyesight helps us catch things faster than using our hearing.

Functions of the Nervous System

1. Collecting information about what happens inside and outside the body.
2. Understanding what this information means.
3. According to this information, a signal is sent to the body telling it what to do.
   - The nervous system sends this information from the sensory organs to the brain through the nerves to be processed and interpreted.

• Help your child review the main points in this concept.

Concept 1.3

Light and Sight



Learning outcomes

By the end of this concept, your child will be able to :

- Describe how light transfers energy across distances.
- Develop a model that describes how the behavior of light enables the eye to see objects.
- Explain how adaptations help some animals gather information in the dark.



Key Vocabulary

- Feature
- Light
- Matter
- Opaque
- Pupil
- Reflect
- Transparent

Lesson 1

Activity 1

Can You Explain?


Fishing cat
Human
Tarsier monkey

- In the previous concept, you have learnt that animals have senses like humans.
- Some animals have some super sensory adaptations to survive.
- Humans and animals have a nervous system that sends information from the sense organs to the brain through the nerves for processing and preception.

Do you know what is the organ that is affected by light in humans and animals and how they can see things in low-light places ?

- The eye is the organ of sight that is affected by light in humans and animals.
- Humans cannot see in the dark, but they need light to gather information about what is happening around them.
- Some animals have a spectacular night vision, which enables them to see at night such as :
  - **Fishing cat** has a special eye structure that helps it to find its prey in the dark.
  - **Tarsier monkey** has huge eyes that can see almost everything in the dark.

Notes for parents

- Discuss with your child how humans and animals see things in low light places.

From the previous explanation, we conclude that :

- Some nocturnal animals can see better than humans in the dark.
- Living organisms can obtain light from many sources, such as :


The Sun


Candles


Electric lamps

In this chapter, we will study :

- Some animals that can hunt in the dark.
- Some special structures of eyes for some animals.
- Light is a source of energy.
- The reflection of light.
- How we can see different objects around us.

• Let your child think about other sources of light

Activity 2

Hunting with Night Vision

▸ **Look at these pictures, then put (✓) or (✗) in front of the sentences below:**



Human



Cat

- Human can see clearly in an area with low light. ( )
- Cat can see clearly in an area with low light. ( )

Vision in humans and animals

- Humans use the sense of sight to gather information about what is happening around them. To see well, humans eyes need light but in the absence of light, human eye would need a night vision goggle to see in the dark.



Night vision goggle

- There are some animals that have a structural adaptation in their eyes, which helps them see at night during the dark to hunt their preys, such as the fishing cat.

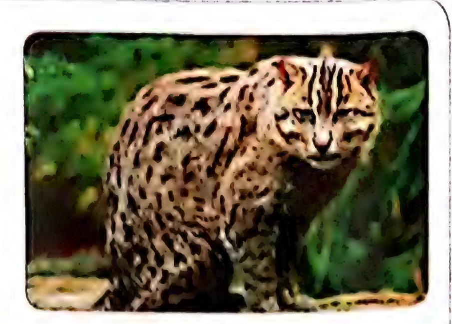
The fishing cat

It is a wild cat that hunts during the nighttime, as the structure of its eyes helps it to find its prey in the dark.

- **Its structural adaptation :**

The fishing cat's eyes seem to glow in the dark and that's because :

- They have a mirror-like membrane on the back of their eyes.



Fishing cat

Notes for parents

- Discuss with your child the structural adaptation of the fishing cat's eyes.

- When light enters its eyes, it bounces off this membrane, allowing the eye to collect more available light, and this causes the cat's eye to appear bright.
- This adaptation allows cats to have excellent night vision that they use to hunt successfully in the dark.

Note

All cats have a membrane that acts as a mirror at the back of their eyes.

Check your understanding

▸ **Mention the name of two animals that can hunt at night based on their super sense of sight.**

....

....

▸ **Give a reason for :**

The fishing cat's eyes seem to glow in the dark.

....

....

▸ **Put (✓) or (✗):**

1. The type of adaptation in the fishing cat's eyes is a behavioral adaptation. (   )
2. The membrane in a fishing cat's eyes is found in all animals that are active during the nighttime. (   )

• Let your child answer the questions to check his/her understanding

Activity 3

What Do You Already Know About Light and Sight ?

Sources of light

▸ **There are many sources of light.**

Source of light :

It is something that gives off (emits) its own light.

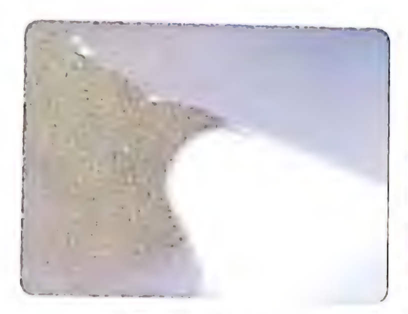
Examples of sources of light



The Sun

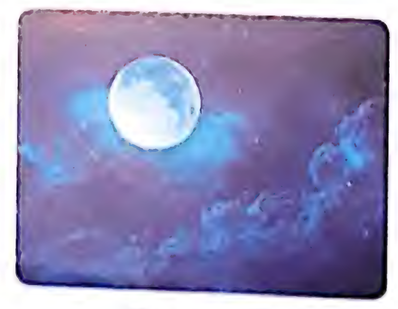

Electric lamps


Candles


Flashlight


Fire

▸ **There are other objects that don't emit their own light, but they reflect the light falling on them, so they are not considered as sources of light such as :**


The Moon

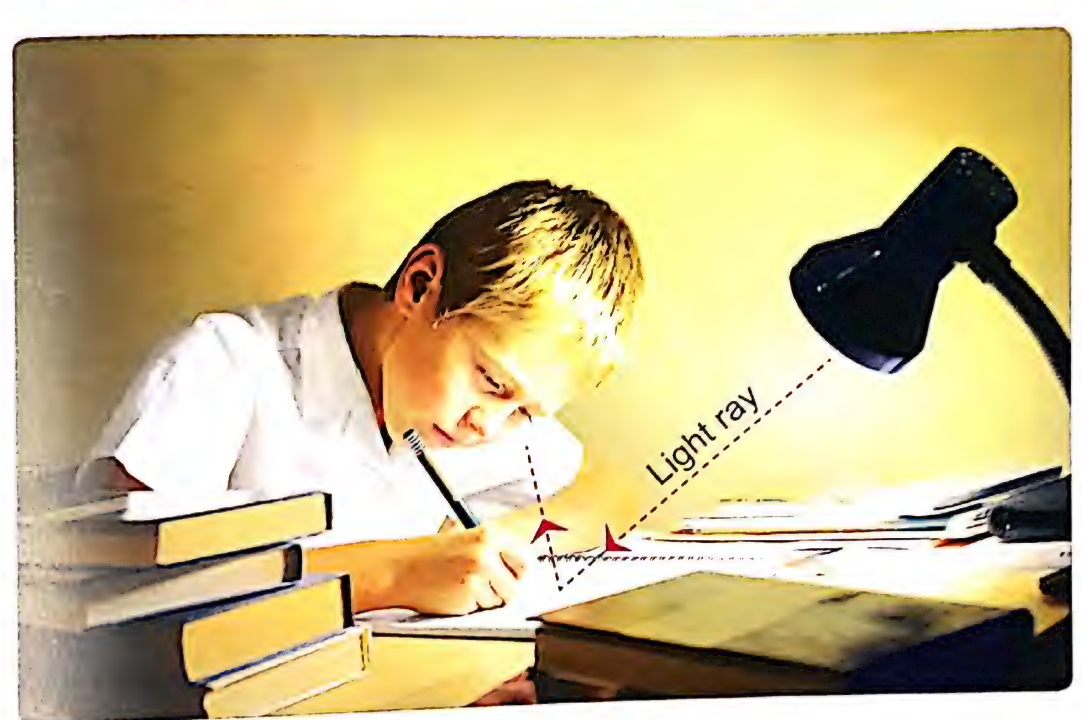

Mirror

Notes for parents

• Discuss with your child the meaning of source of light and the examples of sources of light

How we see

- Some people think that there are light rays emitted from the eyes and fall on the objects around us so we can see these objects, but this is **not true**.
- **In fact** we can see objects due to the presence of a source of light that emits light rays that fall on objects and bounce off these objects to the eye to see them, as shown in the figure.



Check your understanding

▸ Complete :

There are many sources of light such as ...., ... and ....

▸ Put (✓) or (✗) :

1. The light falling on an object bounces back to reach the eye so that we can see. (   )
2. The Moon is considered a source of light so it appears luminous at night. (   )

In the Exercises Book :

Try to answer :

- Exercises on Lesson (1) p. 69
- Self-Assessment (12)

• Discuss with your child how we see in the presence of a source of light

Lesson 2

Activity 4

Hunting in the Dark

▶ **Put ✓ in front of the living organisms that can easily see in the dark during the nighttime :**









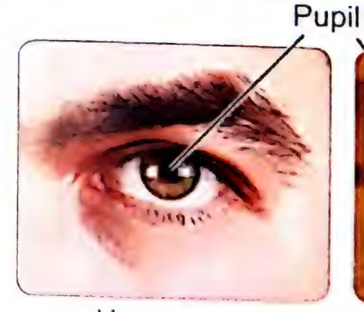




You have learnt from the previous lessons that it is difficult for a person to see clearly in the dark, but many nocturnal animals have spectacular night vision, because they hunt their preys at night and avoid predators so, they adapt to see in the dark.

The differences between human eyes and nocturnal animal eyes

- Nocturnal animals have bigger eyes which are more sensitive to light than humans.
- The pupils of their eyes usually open wider than the pupils of humans' eyes, to allow more light enters their eyes.



Human eye


Cat eye



Nocturnal animals can detect the environment around them in the weakest light levels, but in complete darkness they depend on other senses such as hearing, touching and smell, that help them hunt and move in the dark.

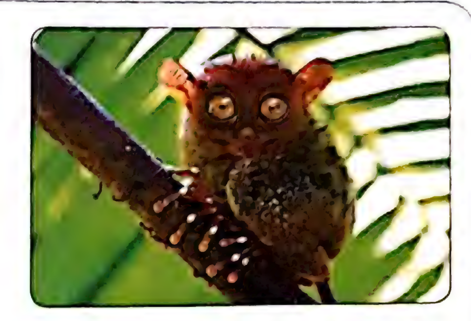
Notes for parents

• Discuss with your child the differences between human eyes and nocturnal animal eyes.

▸ **Now, we will study another example of these nocturnal animals :**

The tarsier

- **Its environment :**
  Southeast Asia.
- **Its type :**
  Tiny "primate" monkey from mammals.
- **Its length :**
  About 10 centimeters long, not including its tail.



Tarsier

- **Its food :**
  Insects, small lizards or birds.
- **Its structural adaptation :**
  The tarsier like owl in some structural adaptations such as :

  1. **Eyes :**
     - **Tarsier has huge eyes like owl**, to gather and reflect any light available to give it a picture of its surrounding.
     - Tarsier can't move its eyes in their sockets like owl.
  2. **Head :**
     - **Tarsier can turn its head 180 degrees like owl**, to focus on distant or near objects at night.

Check your understanding

▸ **Put (✓) or (✗):**

1. Human needs a source of light to see clearly in the dark. ( )
2. Human eyes have a structural adaptation similar to those of cats and tarsiers. ( )
3. Cats have wide pupils to help them see in low light. ( )
4. Tarsier can rotate its head in wide directions. ( )

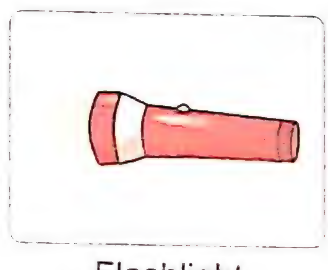
• Discuss with your child the structural adaptation of the tarsier.

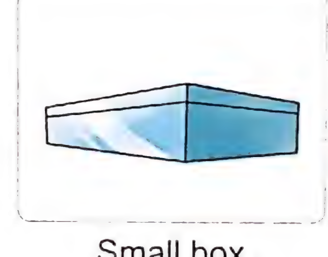
Activity 5

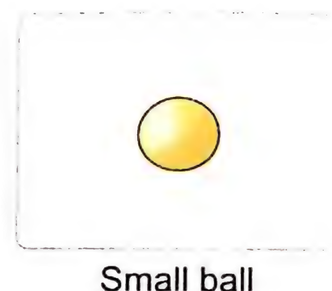
Light Observations

- You have learnt in the previous lesson that our eyes need light to see objects clearly.
- **Now,** we are going to do an experiment to show that human needs light to be able to see things in dark places clearly.

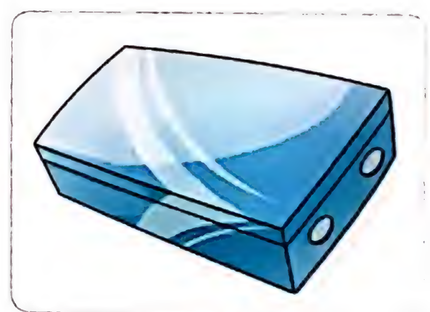
Tools


Flashlight

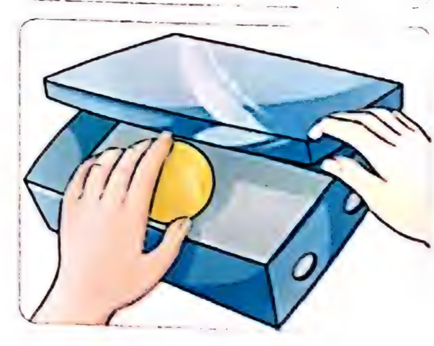

Small box


Small ball

Steps



1. Make two holes on one side of the box next to each other so that the distance between them is approximately 5 cm.



2. Place the ball inside the box and close it.



3. Cover one of the holes with your hand and look through the other hole to see the ball.

Notes for parents

- Let your child do the experiment to know the importance of light

Observation

You won't be able to see the ball.

4. Take your hand away and replace it with a turned on flashlight, and look again through the other hole to see the ball.



Observation

You will see the ball clearly.

Explanation

- We wouldn't be able to see the ball when the box was completely dark, because there is no light source and also the ball don't emit light.
- But, when there is a light source, we can see clearly, because the light from the flashlight falls on the ball and then returns to the eye, so we can see.

Conclusion

Presence of light is necessary for us to be able to see things clearly.

Check your understanding

Put (✓) or (✗):

1. We can see objects that emit light or reflect light on our eyes. (   )
2. There must be light to be able to see things clearly in dark places. (   )

In the Exercises Book :

Try to answer :

- Exercises on Lesson (2) p. 74
- Self-Assessment (13)

• Help your child to conclude that the presence of light is necessary for humans to be able to see things clearly.

Lesson 3

Activity 6

Light Is Energy

▶ Look at the opposite figure, then put (✓) or (✗) in front of the following sentences :



1. The boy can see the different objects in the room because his eyes sense the light and his brain tells him what he is seeing. ( )
2. If the light is turned off, the boy will see the different objects in the room. ( )

- You have learnt about how the nervous system works with sense organs.
- Seeing with our eyes is a way to collect information about the world around us.

• **Now,** let's learn how light helps the eyes see.

What is light ?

Light :

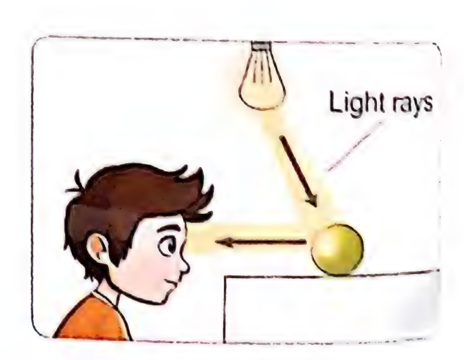
It is a visible form of energy that travels in the form of light waves.

▶ In order to see an object :

Light must bounce off an object into the eyes.



Then the eyes send messages to the brain, where the information is processed so, the brain interprets the messages as an image of a ball.



Notes

- It is much easier to see objects in bright light compared to objects in dim light.
- In the absence of a light source, the human eye cannot see anything.

Check your understanding

▶ Put (✓) or (✗) :

1. The human eyes can see in a completely dark room. ( )
2. The nervous system has an important role in vision. ( )

Notes for parents

• Discuss with your child the meaning of light and how light helps the eyes see.

Activity 7

Special Eye Structures

- You have known how light impacts humans' ability to see.
- In order for humans to see an object, light must fall on the object and be reflected into the eyes, then the structures in human eyes transmit messages to the brain to tell humans what they are seeing.

• **Now,** we will learn about a structural feature in the eye of some animals that allows them use very small amounts of light in a highly effective way.

Special eye structures

Deers, horses, cats and dogs have a feature that relates to the sense of sight, called the "tapetum lucidum".



Tapetum lucidum

Tapetum lucidum is a thin reflective layer, at the back of some animals' eyes that reflects light as you have studied this layer in fishing cat's eye.

Note
Tapetum lucidum is a Latin term which means **"tapestry of light"**.

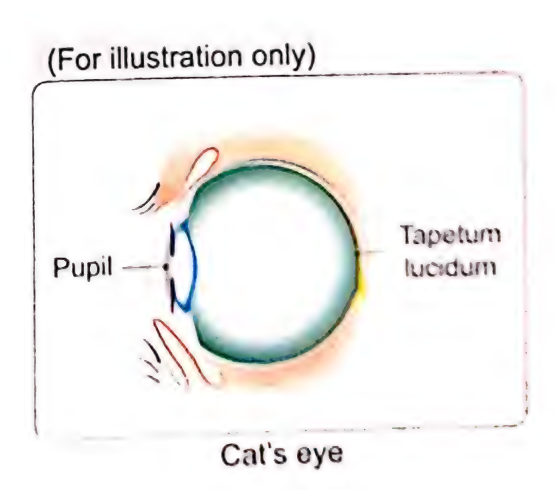
▶ **Tapetum lucidum is a structural adaptation that help some animals to :**

- See and hunt at night.
- Avoid being hunted at night.

How tapetum lucidum works :

- When the light enters the eyes of such animals and falls on the tapetum lucicum layer, it bounces off it like a mirror.
- The light that the eyes do not detect at first passes through to the tapetum lucidum and get bounced back for second time that makes the eyes of such animals get more amount of light at nighttime.

(For illustration only)



Cat's eye

• Discuss with your child the structural adaptation that some animals have in their eyes.

Note

The reflection of light from tapetum lucidum causes the glow of the cat's eyes when light shines on them in the dark.

Check your understanding

Put (✓) or (✗), then correct the wrong ones :

1. Horses' eyes are structured to use light reflection in order to see well in low light conditions. ( )
2. Tapetum lucidum is a structural adaptation in the human eyes. ( )
3. Cats can see in the dark due to the presence of a thin reflective layer in their eyes. ( )

Give a reason for :

The presence of tapetum lucidum in the eyes of some animals.

....

....

Choose the correct answer :

Dogs have a structural feature that is related to the sense of .... called tapetum lucidum.

a. hearing b. smell
c. sight d. taste

In the Exercises Book :
Try to answer :
- Exercises on Lesson (3) p. 78
- Self-Assessment (14)

Notes for parents

- Let your child answer the questions to check his/her understanding

Lesson 4

Activity 8

Reflection

▸ **Look at the opposite figures, then answer :**

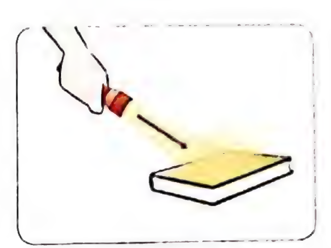


Figure (A)

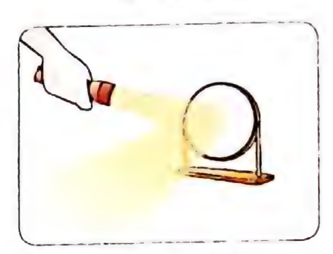
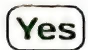


Figure (B)

1. Do you think light will reflect in figure (A) ?





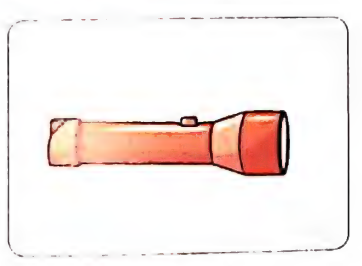
2. Do you think light will reflect in figure (B) ?



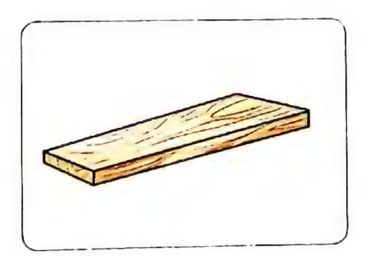


Now, we will do an experiment that shows how light interacts with different types of materials.

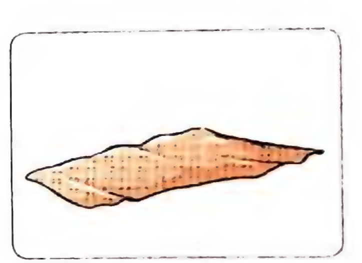
Materials



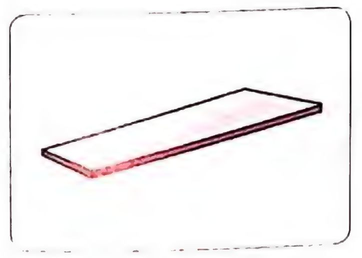
Flashlight



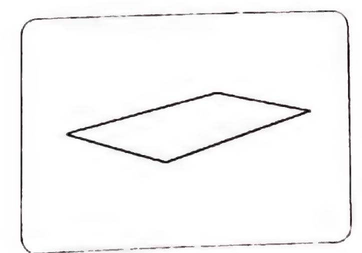
Piece of wood



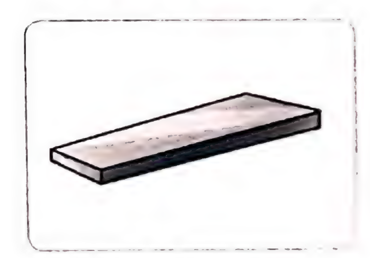
Piece of cloth



Piece of plastic



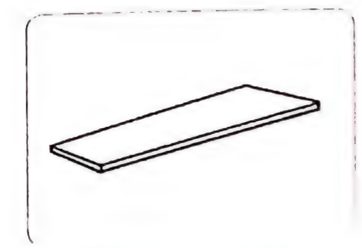
Paper



Piece of metal



Mirror



Piece of glass



Shine the flashlight on each of the previous different materials.

• Let your child do the experiment to know how light interacts with different types of materials

Materials	Figures	Observations
The piece of plastic.		Plastic reflects small amount of light rays.
The piece of wood.		Wood reflects small amount of light rays.
The piece of cloth.		Cloth reflects small amount of light rays.
The mirror.		Mirror reflects large amount of light rays.
The paper.		Paper reflects small amount of light rays.
The piece of metal.		Metal reflects large amount of light rays.
The piece of glass.		Glass reflects very small amount of light rays.

Notes for parents

- Let your child observe how the light interacts with different materials.

Conclusions

- Shiny and smooth materials (such as : mirror and metal) reflect light better than the other materials.
- Rough materials (such as : plastic, wood, cloth and paper) reflect light less than smooth materials.
- Transparent materials (such as : glass) reflect very small amount of light.

Check your understanding

Put (✓) or (✗):

1. Shiny objects tend to reflect light better than rough objects. (   )
2. Wood reflects light more than a mirror. (   )
3. Glass reflects light less than metals. (   )

Choose the correct answer :

1. Which of the following objects is shiny and smooth ? ....

   a. Metallic spoon.   b. Plastic spoon.

   c. Wooden chair.   d. T-shirt.

2. All the following materials are rough except ....

   a. cloth.   b. mirror.   c. wood.   d. paper.

• Let your child answer the questions to check his/her understanding.

Activity 9

Light Strikes Matter


Light reflection

- You have learned about how different materials reflect light.
- **Now**, we will learn how light behaves when it interacts with different types of matter.

Light strikes matter

• Light is a form of energy that always travels in straight lines in the form of waves.

▶ **When traveling light hits an object :**

- Some of the light energy is absorbed.
- Some of the light energy may go through the object.
- Some of the light energy reflects off (bounces off) the object's surface.

• **Objects that light cannot pass through are called "opaque".**


Opaque object

Opaque objects :

They are objects that don't allow light to pass through.

Examples of opaque substances : plastic, wood and metal.

Why do you see your shadow ?



Opaque objects (including the human body) always form shadows in the presence of light.
Shadow happens because all the light that hits the body either bounces off or is absorbed. So, none of the light passes through the body.

• **Objects that light can pass through are called "transparent".**


Transparent object

Transparent objects :

They are objects that allow light to pass through.

Things can be seen through transparent objects.
Examples of transparent substances : air, water, windows and lenses.

Notes for parents

• Discuss with your child the meaning of opaque and transparent objects and some examples of both of them.

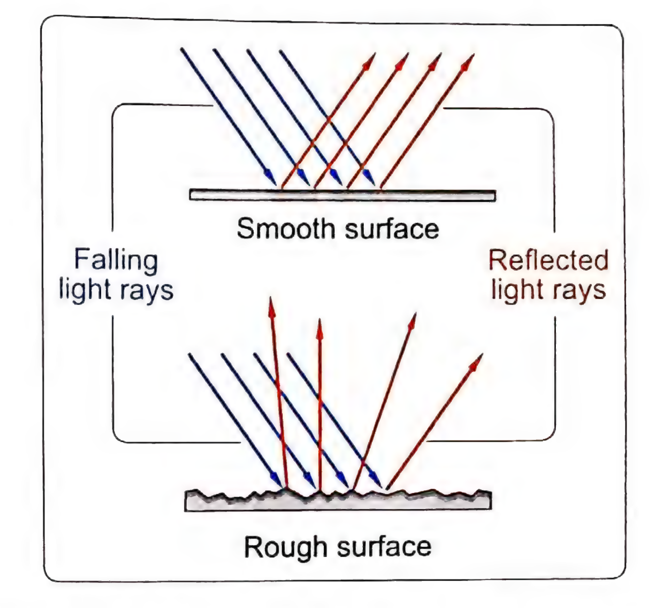
The reflected light depends upon the smoothness of the surface :

- If the surface is a polished mirror, the rays will reflect at the same angle at which they strike (hit) the object originally.
- If the surface is a painted surface (slightly rougher), the rays will reflect in different directions.



Note

Rough surfaces scatter or diffuse light.



▶ **How does light striking matter make it possible for humans and animals to see ?**

When light waves strike an object, light reflects off (bounces off) this object.



The reflected light travels in a straight line into the eyes.



Special nerves in the eyes send messages to the brain.

The brain interprets the messages as an image of this object.

Check your understanding

▶ **Write the scientific term :**

1. Objects that allow light to pass through. (..........................)
2. Objects that don't allow light to pass through. (..........................)



In the Exercises Book :

Try to answer :

- Exercises on Lesson (4) p. 81
- Self-Assessment (15)

• Discuss with your child that the reflected light depends upon the smoothness of the reflecting surface.

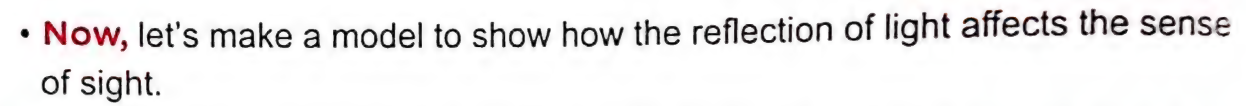
Lesson 5

Activity 10

Sight Model

▶ **Look at the opposite figure, then put (✓) or (✗) in front of the following sentences :**

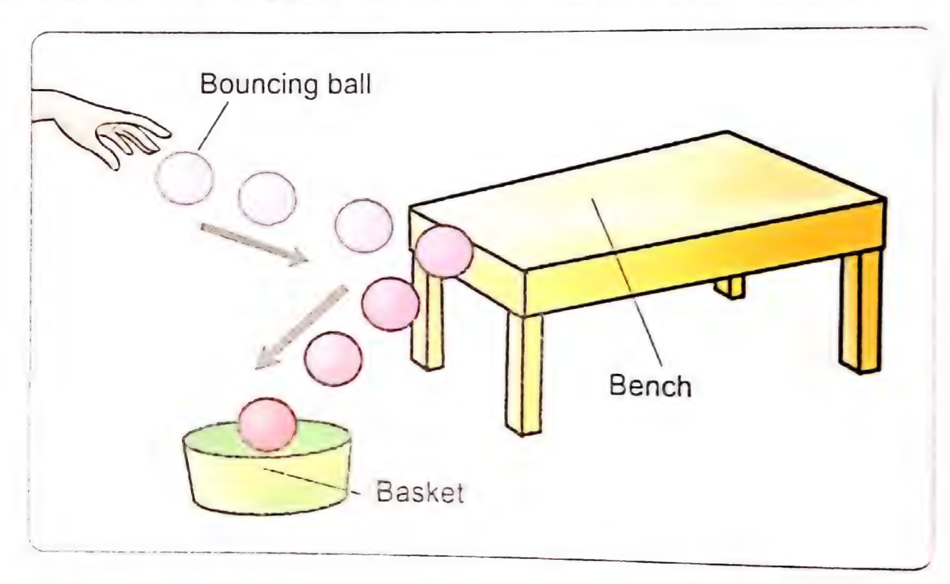
1. Light comes out of the eye and falls on the book so, we can see the book. (   )
2. Light travels from the source of light and hits the book, then reflects off the book into the eye. (   )



• **Now,** let's make a model to show how the reflection of light affects the sense of sight.



▶ **Imagine using a bouncing ball to model how the eye see the reflected light.**



▶ **In this model, if the ball bounces off the bench and go into the basket. According to this model, try to choose the correct answer in the following questions :**

• The bouncing ball represents .... (light rays – the eye – an object)

• The bench represents .... (light rays – the eye – an object)

• The basket represents .... (light rays – the eye – an object)

▶ **From the previous model, we conclude that :**

Light reflects off an object into the eye, so we see the object.

Notes for parents

• Let your child make a model to show how the eye see the reflected light

Activity 11

Record Evidence Like A Scientist

▸ **In this concept, you have learnt a lot about how vision works.**

- **Now,** try to think like a scientist by writing your evidence and your scientific explanation for the question and hypothesis about one of the main points of this concept through the four steps you have learnt in the first concept.

Step 1 The Question

What needs to happen for humans or other animals to see an object in low-light areas ?

Step 2 My Hypothesis (claim)

In low-light areas, light should hit an object that reflects the light to my eyes to see this object.

Step 3 My Evidence

....

....

....

....

Step 4 My Scientific Explanation

....

....

....

....

....

- Help your child to think like a scientist by writing his/her evidence and scientific explanation about the question in step ①.

Lesson 6

Activity 12

STEM in Action

▶ **Look at the opposite picture, then answer :**

1. Does the girl in the picture have a problem in her eyesight ?

Yes   No

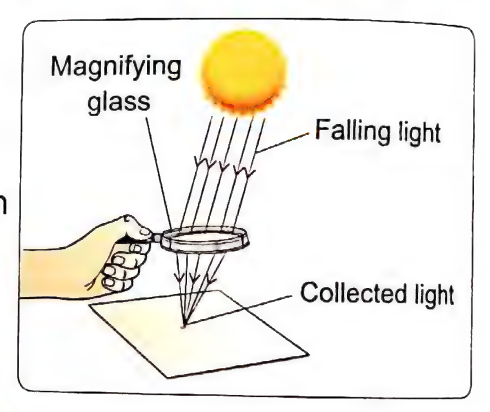


2. Do the glasses that she is wearing work to help her see better ?

Yes   No

• The eye has a lens acts as a magnifying glass.

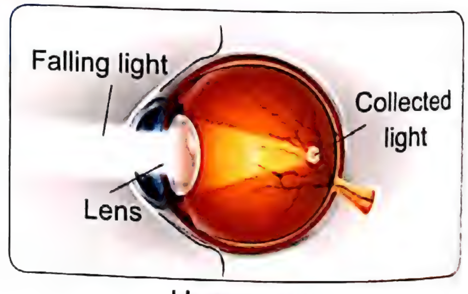
• The magnifying glass can take the sun rays and concentrate them on a single point, as shown in the figure. As well as, the eye works in the same way.



What happens when the light reaches the eye ?

• The lens inside the eye focuses the light that falls on it onto the back of the eye.

• When the lens focuses light, it collects the light in a point, so you can see different objects.



Human eye

How do optometrists help us see ?

• If the lens in the eye does not focus the light properly, the person may have blurry vision.

• Some people are not able to see far objects, while some other people are not able to see near objects. Also, there are some other people have difficulties distinguishing between colors.

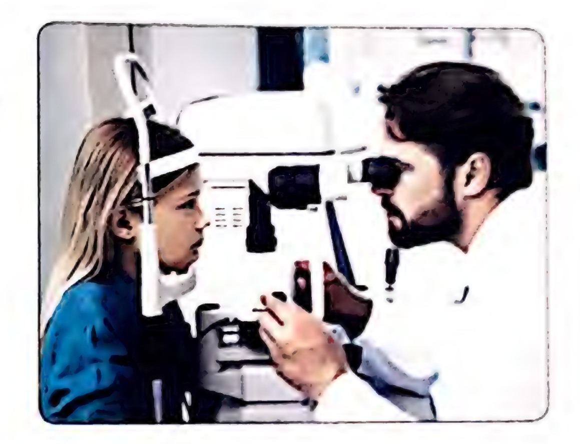
Note

Optometrist : A doctor who specializes in vision and eyesight.

Notes for parents

• Discuss with your child how the eye lens works when the light reaches the eye.

- Optometrists can test the eyes to determine whether the lens in focusing the light properly.
- An optometrist can determine how to correct the vision by different ways such as :
  - Using glasses or contact lenses.
  - Using laser surgery.



Note

Optometry students learn how to prevent blindness, treat eye diseases and correct vision.

Check your understanding

Put (✓) or (✗) :

1. The lens inside the eye focuses the light onto the back of the eye. (   )
2. Optometrist can correct the problems of eyesight by using laser surgery. (   )
3. If a person is not able to see far objects this means that his eye lens is focusing the light properly. (   )

In the Exercises Book :

Try to answer :

- Exercises on Lesson (6) p. 86
- Self-Assessment (16)
- Model Exam on Concept (1.3)

- Discuss with your child some problems of the eyesight and how optometrists can correct these problems.

Activity 13

Review : Light and Sight

▸ **We can summarize this concept in the following main points :**

- **The fishing cat** is a wild cat that hunts during the nighttime and its eyes seem to glow in the dark.
- All cats have a membrane that acts as a mirror at the back of their eyes.

Source of light :

It is something that gives off (emits) its own light.

Examples : the Sun, electric lamps, candles, flashlight and fire.

- There are other objects that don't emit their own light, but they reflect light falling on them, so they are not considered as sources of light such as : the Moon and mirror.
- We can see objects due to the presence of a source of light that emits light rays that fall on objects and bounce off these objects into the eyes, then the eyes send messages to the brain, where it interprets the messages as an image.
- Nocturnal animals have bigger eyes which are more sensitive to light than humans.

- **The Tarsier** is a tiny "primate" monkey from mammals.
  - Tarsier has huge eyes to gather and reflect any light available.
  - Tarsier can turn its head 180 degrees to focus on distant or near objects at night.

Light :

It is a visible form of energy that travels in the form of light waves.

- Light travels in straight lines.
- In the absence of a light source, the human eye cannot see anything.

- **Tapetum lucidum** is a thin reflective layer, at the back of some animals' eyes such as deers, horses, cats and dogs.
- Tapetum lucidum is a structural adaptation that helps some animals to see, hunt and avoid being hunted at night.
- Shiny and smooth materials (such as : mirror and metal) reflect light better than the other materials.

Notes for parents

- Help your child review the main points in this concept.

- Rough materials (such as : plastic, wood, cloth and paper) reflect light less than smooth materials.
- Transparent materials (such as : glass) reflect very small amount of light.

Opaque objects :

They are objects that don't allow light to pass through.

Examples : plastic, wood and metal.

- Opaque objects (including the human body) always form shadows in the presence of light.

Transparent objects :

They are objects that allow light to pass through.

Examples : air, water, windows and lenses.

- **The reflected light depends upon the smoothness of the surface :**
  - If the surface is a polished mirror, the rays will reflect at the same angle at which they strike the object originally.
  - If the surface is a painted surface, the rays will reflect in different directions.
- The lens inside the eye focuses the light that falls on it onto the back of the eye and collects the light in a point, so you can see different objects.
- Optometrist can test the eyes to determine whether the lens is focusing the light properly.
- Optometrist can determine how to correct the vision by different ways such as :
  - Using glasses or contact lenses.
  - Using laser surgery.

Concept 1.4

Communication and Information Transfer





Learning outcomes

By the end of this concept, your child will be able to :

- Compare solutions that use patterns to transfer information.
- Develop a model of a communication system with many parts that work together to transfer information from one place to another.
- Argue, using evidence, that light and sound allow for the transfer of information through systems of communication.
- Compare innovative human designs to systems of communication in the natural world.
- Design, test, and evaluate models of information-transfer systems that can send and receive coded information.

Key vocabulary

- Code
- Echolocation
- Pitch
- Satellite
- System

Lesson 1

Activity 1

Can you Explain?



- **How can humans and animals receive and send information ?**
  - You have learned from the previous concepts how humans and animals adapt by using their senses to gather information about the environment around them.
- **Now, we will learn how do humans and animals use light and sound to send and receive information ?**
  - Human can communicate by receiving and sending information through speaking, writing, reading ... etc.
  - Fireflies beetles produce flash lights using their wings to warn off predators or to attract a mate.
  - Whales communicate with each other by using the songs they produce as tones to make music.
- **From the previous explanation,** we can conclude that animals and humans send and receive information with different communication systems.
- **In this concept, we will study :**
  - Firefly light show.
  - Song of whales.
  - Animals communicate with movement.
  - Alphabet and written language.
  - Transferring information.
  - Communication systems.

Notes for parents

- Discuss with your child the different ways that humans and animals can use in communication.

Activity 2

Firefly Light Show

- **Look at these pictures, then answer the questions :**

- Can dolphins communicate with each other through sound ?

Yes No

- Can fireflies communicate with each other through light ?



▸ What do you notice when you look at the opposite picture ?

- You will notice that, it looks like a light show in a forest.
- These lights are not produced by humans. They are produced by thousands of small insects known as "fireflies beetles".



▸ How do fireflies beetles produce the lights they use to communicate ?

- Fireflies produce a chemical reaction inside their bodies that allows them to light up and communicate with other fireflies.

▸ How are fireflies used their senses to communicate ?

1. Fireflies are winged beetles and they use their wings to flash to warn off predators or to attract a mate to reproduce.
2. They naturally flash at regular intervals, but if there is another group of fireflies flashing nearby, they will change their own flash pattern and start over again to match the flash pattern of the other group to communicate.

• Discuss with your child the way through which fireflies communicate

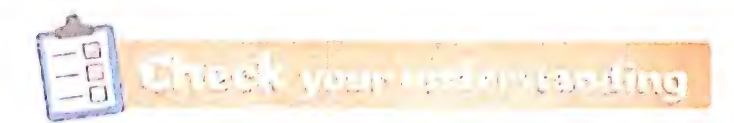
The interaction between humans and nature :

- Humans can influence the fireflies patterns, where a group of artists wanted to discover this influence by using flashing LED lights to imitate the nature of the fireflies patterns as follow :
  - The artists set up lights in the forest to go on and off at regular intervals or in a pattern.
  - A large group of fireflies responded by flashing back at the same time.

The previous explanation shows the interaction between humans and nature and how they can imitate each other.

Note

Humans use lights to communicate with each other to transfer information visually or by using electronic devices.



Complete

1. Fireflies produce a .... inside their bodies that allows them to .... and ....
2. Fireflies use the .... to flash to warn off predators.

Give a reason for:

A group of fireflies change their flash pattern when another group of flashing fireflies comes nearby.

....

....

Notes for parents

- Let your child answer the question to check his/her understanding.

Activity 3

Alphabet and Written Language

- There are many ways to communicate and send messages where, people use **language** to communicate by reading, writing and speaking.
- Whatever how the message is sent, it must be in a language understood by the sender and the receiver.
- The ability to communicate through language and speech separates humans from animals.

Now, we will study how do humans use language to send and receive information :

Egypt	Iraq	Central America
• Around 3000 BCE, ancient Egyptians created hieroglyphics language which is a writing system made up of about 700 symbols.	• Also, around 3000 BCE, the Babylonians in Iraq created a writing system called cuneiform drawings.	• In central America, the ancient Mayans created another hieroglyphs that included almost 800 different signs.

- Letters, like those in an alphabet were developed later.
- At the beginning of the 15th century BCE, various cultures improved and developed a system for writing words using combination of letters.

Paper in old ages :

- Ancient Egyptians created papyrus which is a kind of paper made up of from a reed that grows in the marshes near the River Nile.



Papyrus paper

- Help your child to use some online sources to know more about the old languages mentioned in this activity.

- In 105 CE, the Chinese created a form of paper using the inner bark of mulberry plant and bamboo fibers found in its pulp.


Chinese paper

Note

Written language allows humans to communicate with each other in our present time, understand the past, and share ideas with future civilizations.

Check your understanding

▸ Put (✓) or (✗):

1. Ancient Egyptians created cuneiform drawings. (   )
2. Humans use language to communicate with each other. (   )

▸ Choose:

1. Different types of paper are used in all the following purposes <u>except</u> ....

   a. drawing. b. communication.

   c. transfer written information. d. transfer light waves.

2. Ancient Egyptians use .... plant in making paper.

   a. bamboo b. mulberry c. papyrus d. cactus

Notes for parents

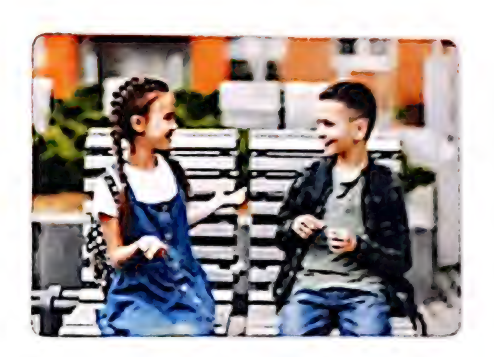
- Let your child answer the questions to check his/her understanding.

Activity 4

What Do You Already Know About Communication and Information Transfer ?

▸ In this activity, we will know :

- How humans and animals communicate and transfer of information.
- The similarities and differences between types of communication in humans and animals.



• Classify each type of communication in the following table by writing : Animal (A) or Human (H) or Both (B) :

Type of communication	Animal (A) or Human (H) or Both (B)
Echolocation :	
Reading :	
High-pitched sound :	
Writing :	
Watching TV :	
Displaying light :	
A cell phone :	
Movements :	
An electronic reader device (e-reader) :	

In the Exercises Book :
Try to answer :
• Exercises on Lesson (1) p. 90
• Self-Assessment (17)

• Help your child to complete the table above to learn the different types of communication used by humans, animals or both

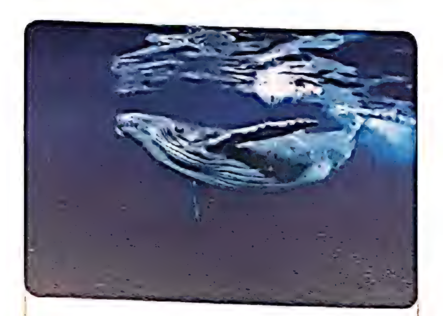
Lesson 2

Activity 5

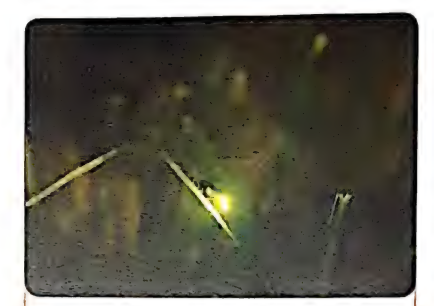
Song of Whales

▶ **Complete the following statements by using these words :**

(Light – Language – Sound)



Whales communicate with each other through ....



Fireflies communicate with each other through ....



Humans communicate with each other through ....

- Although animals do not talk like humans, they still communicate with each other using special systems of communication.
- Animals can use different senses to send and receive information.
- Now, we will study whales as an example of animals that can use songs to communicate with each other under water.

Humpback whales

- Humpback whales sing under water to communicate with each other, where they sing a wide range of notes (tones) and a series of songs.
- Humpback whales songs have different sounds depending on the season, where :
  – They sing during the winter months which is the mating season.
  – They sing other songs during the summer months.
  – They sing other different songs during the feeding season.



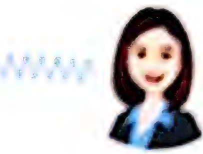
Notes for parents

- Discuss with your child the way of communication that humpback whale use.

Note

Sound is described as :

- High-pitched sound which is soft such as "the voice of woman".



- Low-pitched sound which is rough such as "the voice of man".



- **Similarly**, the voice of humpback whales is high-pitched or low-pitched according to the seasons, where :

In winter	In summer
The songs of humpback whales have high-pitched sounds.	The songs of humpback whales have low-pitched sounds.
High-pitched sounds travel better through cold water.	Low-pitched sounds travel better through warm water.

Note

- Humpback whales know when to change the pitch of their voices.

Check your understanding

Choose the correct answer :

- The rough voice of lions is .... pitched sound.

  a. high b. low c. soft

- The songs of whales have a .... pitch in winter.

  a. higher b. lower c. rough

- Humpback whales sing during the winter months which is considered the .... season.

  a. feeding b. mating c. migration

• Let your child answer the questions to check his/her understanding

Activity 6

Transferring Information

▸ **You have known from the previous concepts that :**

– Sense organs collect information about the world around us then send it to the brain through nerves for processing and understanding.

– The senses can also be used to communicate, or share information with others.

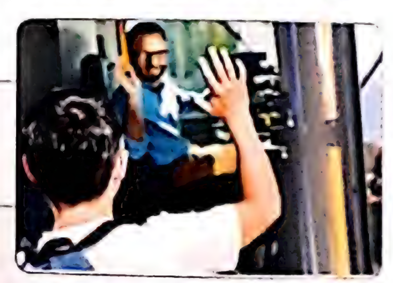
Examples :

1. Ears detect sound energy to gather information from the environment and communicate with others.
2. Eyes use light energy to gather information from the environment and communicate with others.

▸ **The different kinds of information that the eyes receive :**

• Our eyes can detect light that travels very fast through the air, this means that our eyes can detect signals that travel very fast over different distances such as :

1 When someone waving at you from a distance, you see him and understand what he means.



2 When your eye see a red traffic light, it sends a signal to stop.



3 People use a rescue flare to communicate with each other.



4 People use signal fires to communicate over distances of many kilometers.



Notes for parents

• Discuss with your child the different ways that humans use to tranfer information.

5 Many hikers (travelers) use mirrors for flashing to attract the attention of rescue helicopters and communicate with them.



6 Lighthouses encode information in flashes of light that tell sailors where they are.



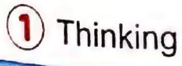
Codes and transferring information

Code :

It is information that transformed into another representative form (such as using dots and dashes to represent letters).



- Humans use codes to transmit information.
- Codes can be as simple as a thumbs-up or thumbs-down or a red or a green traffic light.
- Expressions on faces are codes that can help people predict our feelings such as :



① Thinking



② Feel happy



③ Feel sad



④ Feel angry



• Discuss with your child the meaning of code and let him/her mention other examples of codes that humans can use.

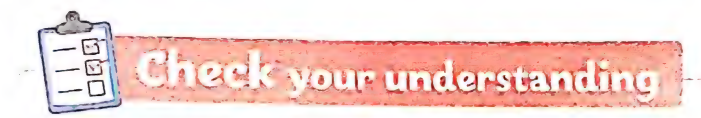
Other forms of codes :

1. **Language :** It is a code in a form of sound, where different languages are different codes, but they all enable the transfer of information.

2. **Writing :** It is a code that uses symbols in a pattern to give a specific meaning according to the arrangement of letters in a word.

3. **Music or Sounds :** Different sound tones produced from humans, musical instruments, ... etc. can be used in communication.

▶ **When sense organs receive this information and send messages to the brain, the brain decodes and interprets the meaning.**



▶ **Complete :**

1. Sense organs collect information about the world around us and send it to the .... through .... for processing and understanding.
2. From forms of codes are .... and ....
3. The .... is the information that transformed into another representative form.

In the Exercises Book :
Try to answer :

• Exercises on Lesson (2) p. 94
• Self-Assessment (18)

Notes for parents

• Let your child answer the questions to check his/her understanding.



Activity 7

Inventing a code

- Humans can communicate through sounds ?



- Fireflies can communicate through light ?



- You have known from the previous lessons that fireflies use flashing light patterns to send messages.
- Humans have designed similar code systems using light or sound, one of these systems is Morse Code.

Morse Code

1. It is a communication system developed by Samuel Morse in the 19th century.
2. It is a simple code consists of short beeps known as dots and long beeps known as dashes. Different dashes and dots represent different letters of alphabet.
3. This code allows people to spell words using sounds of long and short beeps.



Morse code device



Note

Sometimes, in Morse code people can use long and short flashes of light instead of long and short beeps.

- **Now, we will invent a code that is similar to Morse code in this experiment to send and receive messages without talking.**

- Discuss with your child the meaning of Morse code.
- Let your child use some online sources to know more about Morse code.

Tools



A flashlight.



Pencils.



Notebooks.



A small drum.

Steps



1. Share one of your friends to create a unique code (signal) for every letter of the alphabet.
2. Each one of you should write down this code in his notebook.
3. On a separate sheet of paper, write a unique message that is no more than five words (without being seen by your friend).
4. Stand on one side of the room (where you are the sender) holding the drum and your friend on the other side of the room (where he is the receiver).
5. Use the drum to send your encoded message to your friend (the receiver).
6. Let your friend decode your message according to the code you have created.
7. Repeat the previous steps by using the flashlight instead of the drum.
8. Talk with your friend to compare the two messages that he was received even by using the drum or the flashlight to the original message you have wrote in step ③.

Observations

- You and your friend may have incorrectly sent signals or incorrectly interpreted them.
- Your code may have included the same encoding for more than one letter.

Notes for parents

- Try to do the previous experiment with your child.
- Discuss with your child the incorrect sent or received signals if found.

Conclusion

- We can send encoding message to communicate with each other through different ways such as :
  1. Using light energy that depends on the sense of sight.
  2. Using sound energy that depends on the sense of hearing.

Note

To improve your code you can :

- Simplify your code.
- Make the letters more distinct.

Check your understanding

Put (✓) or (✗) :

1. In Morse code, we use sound to send encoding message to communicate with each other. ( )
2. Morse code consists of long beeps known as dots and short beeps known as dashes. ( )

In the Exercises Book :
Try to answer :
- Exercises on Lesson (3) p. 98
- Self-Assessment (19)

• Let your child answer the questions to check his/her understanding.

Lesson 4

Activity 8

Animals Communicate with Movement

▶ **Look at these pictures, then put (✓) or (✗) :**



1. Humans can communicate with each other through sound or light. (   )



2. Bats can communicate with each other through light. (   )

- You have known from the previous lessons that humans and animals use variety of ways to communicate as sound, light and movement.
- Now, we will study the honeybees as an example of animals that use movement to communicate with each other.

Bees and how they communicate with each other

- Bees use movement to communicate with each other.
- In the hive, bees can communicate to find **food and water resources** by doing a special dance, and the movements of this dance represent a code to communicate with each other, where :
  - The dancing bee moves in a figure-eight pattern, while vibrating its wings.
  - These movements of the dance **tell the other bees the correct direction and distance to the food resources.**
  - The bees in the hive read the code of the dancing bee and then fly off to the specific location.



Notes for parents

- Discuss with your child the way through which honeybees communicate with each other using some special movements.

▸ **From the previous explanation,** we can conclude that :

- Honeybees use movement to send messages to communicate with each other.
- Also, humans use movements to communicate such as :

  - **Sign language** that is used by people of special needs.
  - **Simple gestures**.

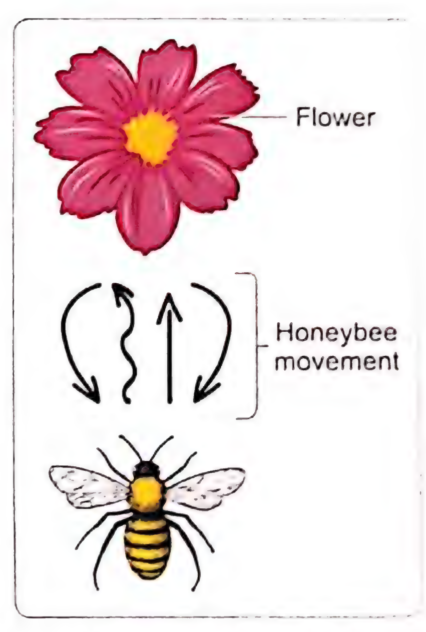


Sign language

Coding with honeybees

▸ **What is the code used by bees to find food ?**

- The scout honeybee faces the direction of the flower.
- The bee does one round dance if the flower is very close.
- The bee does a waggle dance to the right and then to the left if the flower is a little farther away and this is considered as one dance.



Honeybee dance key

▸ **From the previous explanation,** we can conclude that the scout honeybees use codes with movements to communicate with other bees that receive these codes through the sense of sight.

Check your understanding

▸ **Complete :**

1. Animals can communicate with each other through .... , ... and ....
2. People of special needs use .... to communicate with each other.
3. In the hive, bees can communicate to find .... and .... resources by doing a special dance.

• Let your child answer the questions to check his/her understanding.

Activity 9

Communication Systems

▸ **You have learnt about several different ways that humans and animals use to communicate specific messages to each other.**

- **Now**, we will study some of communication systems that humans have designed and used to facilitate communication.
- Human communication systems are made of several parts that work together to send and receive information.

System :

It is a group of related objects that work together to perform a function.

Examples of communication systems :

- When we use some electronic devices such as a cell phone, a computer connected to the internet or watching TV connected to cable TV, this means that **we are using communication systems** that depend on **signals** in their work.
- The previous electronic devices are parts of communication systems, but there are many other parts that work to transfer information from one place to another such as :


1 Satellites




2 Communication towers



3 Software



- When all these parts (elements) come together and each part works correctly, the communication system can perform its work in a way that individual parts cannot.

Notes for parents

- Discuss with your child the different parts of the technological communication systems.

Example :

A cell phone by itself cannot help you to talk to your friends, because it is one part of a communication system that consists of many parts (satellites, communication towers and software) that are integrated with each other to complete the function of communication between people.



Check your understanding

▸ Put (✓) or (✗) :

1. The electronic devices work to transfer information without being connected to satellites, communication towers and software. (   )
2. Satellites and communication towers are used to transfer information from one place to another. (   )
3. The cell phones communication system depends on signals in its work. (   )

• Let your child answer the questions to check his/her understanding.

Activity 10

How Animals use Communication Systems

▸ **You have known from the previous activity that humans use technology systems to communicate with each other.**



- Animals don't use technology systems as we do, but they can still use other systems to communicate with each other.
- We will study ants as an example of these animals.

Ants



- Ants live in colonies that contain thousands of individuals.
- Groups of ants within a colony have different roles, where they have developed systems that help them divide their work among themselves, so there are nurse ants, scout ants and soldier ants.

How do groups of ants communicate with each other ?

1. When the food is low, nurse ants send strong smelly messages to scout ants which are responsible for locating food.



2. The scout ants respond by sending a smelly message to alert the ants where to find the food.

Note

The soldier ants also use smelly messages to communicate if there is danger nearby.

Check your understanding

▸ **Complete :**

1. When the food is low, ... ants send strong .... to .... ants which are responsible for locating food.
2. The .... ants use smelly messages if there is danger nearby.

Notes for parents

- Let your child search for some online sources to learn more about ants and how they communicate with each other.

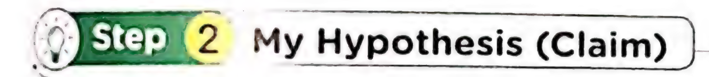
In the Exercises Book :
Try to answer :
- Exercises on Lesson ④ p. 100
- Self-Assessment ⑳

Lesson 5

Activity 11

Record Evidence Like A Scientist

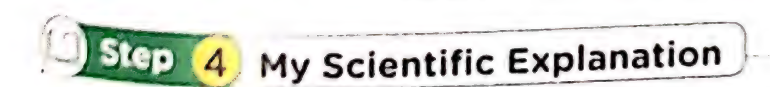
- In this concept, you have learnt a lot about humans and animals communication and transfer information using sound, light and movement.
- **Now,** try to think like a scientist by writing your hypothesis (claim), your evidence and your scientific explanation about one of the main points of this concept through the four steps you have learnt in the previous concepts.



How do humans and animals use light, sound and other methods like movement to send and receive information ?



Step 3 My Evidence



• Help your child to think like a scientist by answering a question about one of the main points of this concept, then write his/her hypothesis, evidence and scientific explanation.

Activity 12

Technology Inspired by Nature



- **You have known from concept (1.2) that many animals such as bats use sound to :**
  - Communicate with each other.
  - Get information about their surroundings using their hearing sense.
- **How bats use their ears to get information about their surroundings in the dark ?**
  - Bats use their ears for echolocation, where they make a high-pitched sound and then listen for an echo (or reflected sound). When bats hear the reflected sound, they know that there is something nearby.

Bat Inspired technology



- **How scientists were inspired by bat echolocation ?**
  - Scientists have been inspired (get benefited) by this adaptation to find ways to help blind people detect their surroundings, where :

Scientists have created a special cane that emits a high-pitched sound just like bats do.



Note

The pitch of this sound is too high for humans to hear.



As a blind person is walking with this special cane, an echo of this high-pitched sound is picked up by this special cane.



The echo is turned into vibrations that the person can feel with his thumb.



Note

The special cane uses vibrations to communicate information about the surroundings to the person using it.



The vibrations of the special cane tell the blind person the direction of the obstacles around him and how close the object is to him.

Notes for parents

- Discuss with your child how scientists created a special cane to help blind people to detect their surroundings.

- In this table we can summarize the similarities and differences between the special cane of blind person and bat echolocation.

Special cane of blind person	Bat
Similarities	
- The special cane of blind person and bats emit a high-pitched sound that bounces off objects with an echo. - This special cane and bats receive the echo that can tell how far away objects are.	
Differences	
- This special cane picks up an echo from the sound it emits and changes it into a vibration that can tell the blind person where objects are around him.	- Bats pick up an echo from the sound they emit but they don't change it into vibrations.

How are the special cane of blind person and the honeybee dance similar ?

- Honeybees make a series of movements and vibrations with their wings to communicate flower location to other bees.
- The special cane makes a series of vibrations to communicate to the blind person using it to tell where objects around him are located.

Check your understanding

Put (✓) or (✗) :

1. Bats make low-pitched sound and then listen for an echo. ( )
2. Bats can change the echo into vibrations. ( )
3. The special cane of blind person picks up an echo and changes it into vibrations. ( )
4. The special cane uses vibrations to transfer information about the surroundings to the blind person. ( )

In the Exercises Book :
Try to answer :
- Exercises on Lesson (5) p. 104
- Self-Assessment (21)
- Model Exam on Concept (1.4)
- Model Exam on Theme (1)

- Let your child know the similarities and differences between the special cane of the blind person and bat echolocation.

Lesson 6

Activity 13

Review : Communication and Information Transfer

▶ **We can summarize this concept in the following main points :**

- Humans and animals use variety of ways to communicate with each other as **sound**, **light** and **movement**.
- Humans use movements to communicate as **sign language** or **simple gestures**.
- Humans can communicate by receiving and sending information using Language by **Speaking** , **Writing** , **Reading** , ... etc.

- Fireflies beetles produce flash lights using their wings to warn off predators or to attract a mate.

- Ancient Egyptians created hieroglyphics language which is a writing system made up of about 700 symbols.
- Babylonians in Iraq created a writing system called cuneiform drawings.
- Ancient Mayans created another hieroglyphs included almost 800 different signs.

- Humpback whales sing under water to communicate with each other.
- In winter, the songs of humpback whales have high-pitched sounds that travel better through cold water.
- In summer, the songs of humpback whales have low-pitched sounds that travel better through warm water.

Code

It is information that transformed into another representative form.

- Humans use codes to transfer information.
- Morse code is a simple code consists of short beeps (dots) and long beeps (dashes).
- Bees use movement to communicate with each other to find food and water resources by doing **a special dance** that represents **a code.**

- Human communication systems are made of several parts that work together to send and receive information.

System :

It is a group of related objects that work together to perform a function.

- The electronic devices work to transfer information when they connect with satellites, communication towers and software.
- Ants communicate with each other through their sense of smell.
- Scientists created a special cane that emits a high-pitched sound just like bats do, to help blind people detect their surroundings.

Notes for parents

- Help your child review the main points in this concept

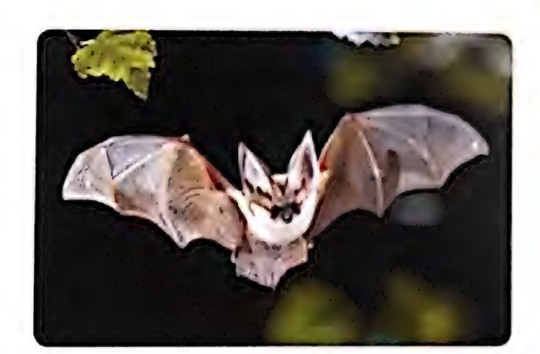
UNIT ONE Project

Bat Chat

In this project, you will make a research about bats to learn how their adaptations help them to navigate, hunt and communicate.

▸ **Read the following paragraph to learn some facts about bats.**

- Bats live in dark places such as caves, where there is not enough light for them to see.
- Bats fly very fast, so they need to be able to avoid hitting different objects during their flying.
- Bats use sound to move around in the dark and also to hunt. To do this, they make a noise in their throats that is very high pitched, so humans cannot hear it.



Bat

- When this noise hits the objects around, it bounces back to the bats ears, that allow bats detect where these objects are, so they can avoid hitting these objects while flying, and this process is known as "echolocation".
- In the same way, bats use echolocation property to hunt their preys even if they are tiny as mosquitoes.
- Bats also use sound to communicate with each other, as they make different sounds that mean different things.
- Scientists have discovered that most of sounds that bats produce are arguments about food or where to get sleep.



▸ **Use the previous paragraph, other printed or online sources to write your hypothesis, evidence and scientific explanation for the following question :**

• Let your child read the paragraph about bats and help him/her to search for more information about them in other

The Question

Why it is helpful for bats to use different sounds to navigate, hunt and communicate ?

My Hypothesis (Claim)

....

....

My Evidence

....

....

....

My Scientific Explanation

....

....

....

....

▶ Use the word bank below to label the following figure :

Word bank Prey – Bat – Echo waves bounce back to the bat – Sound waves produced from the bat

①

②

③

④

- Let your child complete the previous steps and the figure to make a research about bats and share it with his/her friends.

INTERDISCIPLINARY Project

The Sinai Blue Agama Lizard

▶ The Sinai agama is a lizard that can be found in the dry and rocky environments of Eastern Egypt. In order to survive in this hot environment, this little reptile has some adaptations such as :

- Standing on the top parts of its toes, so that its belly stays high above the hot rocks.
- It has a scaly skin (scales) that traps in water.
- It has a long, thin body that helps it climb and run quickly.



Sinai blue agama lizard

▶ Agama lizards save energy as they wait in the shaded areas between the rocks for their preys to come by so that they can attack them. They feed on ants, grasshoppers, beetles and other insects.

▶ The number of Sinai agama lizard decreases as they are negatively affected by human activities such as :

- Catching them to be sold as pets.
- Changing their natural habitat by building roads and sidewalks for people in these areas.

▶ **In this project, use the steps of the Engineering Design Process that you have learnt in the previous educational grades to create a sidewalk design that meets the needs of humans without negatively affecting Sinai agama lizards.**

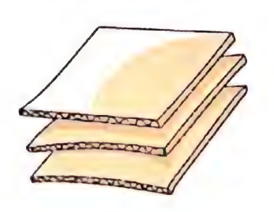
• Let your child find out a solution to an environmental problem through designing a sidewalk for people without affecting the wildlife.

Idea

Create a sidewalk design for people using natural materials such as sand, rocks, wood and clay.

Materials

You may use the following materials to build up your design:


Carton sheets


Small wooden sticks


Paper sheets


Small rocks


Sand


Wax gun

Plan

....

....

....

....

....

....

• In this project help your child to use the steps of the Engineering Design Process which are : idea, materials, planning, building and improvement.

Build

Draw your sidewalk design.

Improve

Write down your ideas to improve your sidewalk design.

Glossary



Concept 1.1

Agama lizard	سحلية العجمة
Adaptation	تكيّف
Antarctica	القارة القطبية الشمالية
Acacia tree	شجرة السنط
Anus	فتحة الشرج
Acid	حمض
Air sacs / Alveoli	الحويصلات الهوائية
Asthma	مرض الربو
Amphibians	برمائيات
Blood vessels	أوعية دموية
Blend	يندمج
Burrow	جحر
Bull shark	قرش الثور
Belly	بطن
Behavioral adaptation	تكيف سلوكى
Buttress roots	جذور داعمة
Barbary fig	تين شوكى
Bron chioles	شعيبات هوائية
Biologist	عالِم أحياء
Characteristic	صفة
Climate	مناخ
Camouflage	التمويه
Caracal	القط البرى
Competition	منافسة
Claws	مخالب
Compartment	حجرات صغيرة
Downy	ناعم
Defense	يدافع
Drought	جفاف
Digestive system	الجهاز الهضمى
Digestion process	عملية الهضم
Diaphragm	الحجاب الحاجز
Esophagus	المرئ
Enzymes	أنزيمات
Exhalation	زفير
Extinction	انقراض
Evidence	دليل
Exhausts	عوادم
Ecosystem	نظام بيئى
Endangered	معرض للخطر
Fennec fox	ثعلب الفينك
Fluffy	رقيق
Generations	أجيال
Gills	خياشيم
Hump	سنام
Hypothesis / Claim	فرضية
Inhalation	شهيق
Impact	تأثير
Kapok tree	شجرة الكابوك
Lack	نقص / ندرة
Large intestine	الأمعاء الغليظة
Liver	الكبد
lung	رئة
Migration	هجرة
Mangrove tree	شجرة المانجروف
Nutrients	المغذيات
Polar / Arctic	قطبى
Pant	يلهث
Prey	فريسة
Predator	مفترس
Panther chameleon	حرباء النمر
Puff up	ينتفخ
Pine tree	شجرة الصنوبر
Poison	سم
Pancreas	البنكرياس
Plowing	تجريف / حرث
Pollution	تلوث
Reproduce	يتكاثر
Reptiles	زواحف
Rainforest	غابة مطيرة
Resist	يقاوم
Respiratory system	الجهاز التنفسى
Respiration process	عملية التنفس
Survive	يبقى حيا
Scales	قشور
Structural adaptation	تكيف تركيبى
Spines	أشواك
Soggy soil	تربة رطبة
Stomach	معدة
Small intestine	الأمعاء الدقيقة

Saliva	اللعاب
Secrete	يفرز
Species	نوع
Tropical	استوائى
Taproot	جذر رئيسى
Trunk	جذع
Throat (pharynx)	البلعوم
Trachea	القصبة الهوائية
Two bronchi	الشعبتان الهوائيان
Unique	فريد
Waxy layer	طبقة شمعية
Weave	نسج
Water lily	زنبق الماء / اللوتس

Concept 1.2

Bowl shape	شكل وعاء
Backbone	العمود الفقرى
Communication	أتصال
Egyptian mongoose	النمس المصرى
Extraordinary	أستثنائى
Echo	صدى
Echolocation	تحديد الموقع بالصدى
Electrical impulses	نبضات كهربية
Gather	يجمع
Integrally	تكاملى
Jerboa	حيوان اليربوع
Mammals	ثدييات
Mosquito	بعوضة
Muscles	عضلات
Nocturnal animal	حيوان ليلى
Nervous system	الجهاز العصبى
Nerves	أعصاب
Processing	معالجة
Reflection / Bounce	أنعكاس / ارتداد
Response	استجابة
Reflex action	رد فعل منعكس
Reaction time	زمن الاستجابة
Rodents	قوارض
Stimuli	مثير / حافز
Spinal cord	الحبل الشوكى

Sensory organ	عضو حسى
Sensory receptors	مستقبلات حسية
Signals	اشارات
Transmit	ينقل
Wave	موجة

Concept 1.3

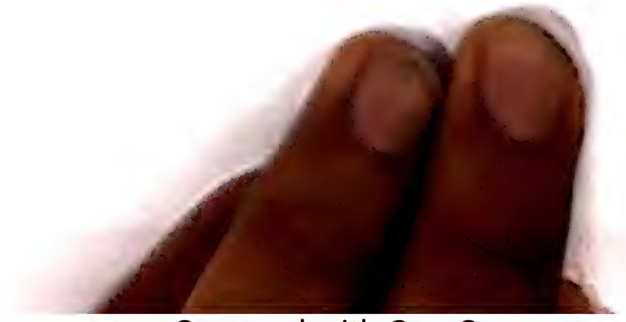
Blurry vision	رؤية ضبابية
Blindness	عمى / فقد البصر
Concentrate / Focus	يركز
Emit	يصدر
Fishing cat	حيوان القط السمّاك
Glow	يتوهج
Interpret	يفسر
Interact	يتفاعل
Lens	عدسة
Laser	الليزر
Membrane	غشاء
Magnifying glass	منظار مكبر
Night vision goggle	جهاز رؤية ليلة
Opaque	معتمة
Optometrits	طبيب العيون
Pupil	بؤبؤ العين
Polish	يلمع / يصقل
Reflective layer	طبقة عاكسة
Shadow	ظل
Scatter / Deffuse	تفرق / تبعثر
Surgery	جراحة
Tarsier	حيوان التارسير
Tapetum lucidum	البساط الشفاف
Transparent	شفاف
Visible	مرئى

Concept 1.4

Babylonians	البابليون
Bamboo	نبات الخيزران
Blind	كفيف
Chemical reaction	تفاعل كيميائى
Cuneiform	مسمارية
Culture	ثقافة

Civilization	حضارة
Code	شفرة
Colonies	مستعمرات
Cane	عكاز
Decode	يحل شفرة
Electronic devices	أجهزة إلكترونية
Encode	يشفر
Fireflie beetles	الخنافس المضيئة
Flash	ومضات
Flare	شعلة
Gestures	إيماءات
Hieroglyphic	هيروغليفى
Humpback whale	الحوت الأحدب
High pitched sound	صوت حاد
Hikers / Travelers	رحالة / مسافرين
Hive	خلية النحل
Imitate	يقلد
Improve	يحسن / يطور
Inner bark	لحاء الشجر الداخلى
Low pitched sound	صوت غليظ
Lighthouse	فنار / منارة
Mayans	شعب المايا
Mating season	موسم التزاوج
Morse code	شفرة مورس
Nurse ants	عاملات النمل
Pattern	نمط / اسلوب
Papyrus	نبات البردى
Pulp	لُب الأشجار
Regular	منتظم
Receiver	مستقبل
Rescue	أنقاذ
Representative	نموذجى
Sender	مرسل
Sailors	البحارة
Sign language	لغة الإشارة
Satellites	أقمار صناعية
Software	برامج الحاسب الالى
Scout ants	النمل الكشاف
Soldier ants	جنود النمل
Series	سلسلة / متوالية
Traffic lights	اشارات المرور الضوئية
Tower	برج

Thumb	[illegible]
Vibrate / Waggle	[illegible]



Exercises

on Lessons of Concept (1.1)

Understand Apply Analyze Evaluate Create

Exercises on Lesson 1

1 Choose the correct answer :

1. Adaptation helps the living organism in all the following characters, except ....
   a. surviving. b. reproduction.
   c. hiding. d. death.
2. The starred agama keeps cool during a hot sunny day in desert by ....
   a. eating green vegetables. b. drinking more water.
   c. secreting more sweat. d. finding a shade area.
3. If a desert lizard is transferred into a cool environment, it will stop ....
   a. looking for a shade area. b. looking for water to drink.
   c. breathing. d. eating.
4. If you catch a piece of ice in your hand, you will begin to lose feeling in your fingers after a few ....
   a. minutes. b. hours.
   c. days. d. weeks.
5. Penguins live in a polar climate which ....
   a. is one of the hotest places on Earth.
   b. is one of the coldest places on Earth.
   c. looks like the desert climate.
   d. looks like the forest climate.
6. The presence of an insulating layer of .... , keep the penguin's body warm.
   a. protein and thick downy feathers b. fat and thin downy feathers
   c. fat and thick downy feathers d. protein and thin downy feathers
7. In penguin's feet, ... weave around each other.
   a. warm blood vessels and cold blood vessels
   b. warm blood vessels and its toes
   c. cold blood vessels and its toes
   d. cold blood vessels and thick downy feathers
8. In penguin's body, the insulating layer of fat and thick downy feathers trap .... against the skin.
   a. cold air b. cold water
   c. warm water d. warm air

9. Penguin's feet have blood vessels that bring .... up from its feet towards its body.
   a. cold water b. warm water c. cold blood d. warm blood
10. Ecosytem is ....
   a. a type of adaptation.
   b. one of human body systems.
   c. a habitat in which living organisms live.
   d. a characteristic that helps living organisms survive.
11. Camouflage means that the animal ....
   a. can be seen easily among its surrounding.
   b. is hard to be seen among its surrounding.
   c. is easily to be seen by its preys.
   d. can be seen easily by its predators.
12. The presence of a thick white fur is an adaptation in ....
   a. starred agama. b. polar bear.
   c. fennec fox. d. forest bear.
13. Bears that live in forests have fur .... that of polar bears.
   a. whiter than b. darker than
   c. similar to d. brighter than
14. Fennec fox and caracal have.......... that help them blend in with desert landscape.
   a. colorful scales b. thick white fur
   c. sandy-colored feathers d. sandy-colored fur
15. When we wear heavy clothes in winter, this is considered as a type of ....
   a. adaptation for cold weather. b. camouflage.
   c. adaptation for hot weather. d. ecosystem.
16. Which of the following birds is more difficult to be seen by its predator ?..........
   a. A red bird on a green tree. b. A blue bird on a green tree.
   c. A yellow bird on a green tree. d. A green bird on a green tree.

2 Put (✓) or (X) :

1. The desert lizard blend in with large green trees, to hide from its enemies. (   )
2. Animals that live in hot deserts have special ways to keep their bodies warm during hot sunny days. (   )
3. Living organisms can survive and reproduce in different environments by the help of adaptation. (   )
4. The insulating layer of fat and the thick downy feathers trap warm air against the skin of the penguin's body. (   )

5. In penguin's feet, the cold blood vessels can warm up the warm blood vessels. ( )
6. Penguin's feet are covered with special type of feathers to keep them warm. ( )
7. Camouflage helps animals adapt the extreme weather conditions in their ecosystems. ( )
8. Thick white fur is an adaptation in bears that live in polar regions. ( )
9. The sandy-colored fur of caracal helps it blend in with snow in polar environment. ( )
10. Some types of lizards have colored feathers to help them blend in with rocks in their ecosystem. ( )

3 Write the scientific term of each of the following :

1. An animal that has a layer of fat and thick downy feathers to adapt extreme cold weather. (.....................)
2. It covers the body of some type of bears to blend in with snow and keeps its body warm. (.....................)
3. A type of foxes that has sandy-colored fur to adapt its desert environment. (.....................)
4. A property that helps animals to blend in with their surrounding environment. (.....................)

4 Complete the following sentences :

1. The penguin's body can keep warm air against its skin through an insulating layer of .... and thick downy ....
2. A penguin can stand around on ice all day due to the weaving of .... around each other in its feet.
3. Animals can blend in with their surrounding environment to hide from their .... and preys through .... property.
4. Forest bears have .... or .... colored fur, while polar bears have .... colored fur.
5. In desert environment, ... and .... are covered with sandy-colored fur.
6. Among animals that can live in desert ecosystem are .... lizard and .... fox.
7. The fur of a polar bear is thick to keep its body .... in polar climate, while it has .... color to blend in with snow.
8. The body of some types of lizards are covered with .... to blend in with colored rocks in their environment.
9. Among animals that can live in polar environment are .... and ....

5 Give reasons for :

1. The starred agama lizard always looking for shade areas in desert.

....

....

2. The blood vessels in the penguin's feet are weave around each other.

....

....

3. The penguin's body has an insulating layer of fat and thick downy feathers.

....

....

4. Some animals have the ability to make camouflage adaptation.

....

....

5. Fennce fox has a sandy-colored fur, while polar bear has a white fur.

....

....

6 What happens if ... ?

1. The warm blood vessels and cold blood vessels in the penguin's feet are not weaved around each other.

....

....

2. The polar bear has a thin fur instead of its thick fur.

....

....

3. The body of fennce fox is covered with a black fur.

....

....

4. Some types of lizards don't have the camouflage adaptation.

....

....

7 Compare between :

1.

Points of comparison	Penguin	Fennec fox
1. Habitat :	....	....
2. Body coat :	....	....

2.

Points of comparison	Polar bear	Forest bear
1. Habitat :	....	....
2. Fur color :	....	....

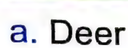
8 Read the following dialogue between animal (X) and animal (Y), then answer the questions below :

Animal (X) : Hello, its very cold today.
Animal (Y) : Hello, in our habitat, all days are always very cold.
Animal (X) : I have to dive now, to find something to eat.
Animal (Y) : I cannot dive but, I just look around to find a prey.
Animal (X) : Ok., good bye.
Animal (Y) : Wait, if I don't find a prey, I will eat you.

- **According to the previous dialogue, put (✓) or (✗) in front of the following sentences :**

1. Both animals (X) and (Y) are penguins. ( )
2. Both animals (X) and (Y) live in polar climate. ( )
3. Animal (X) is a desert lizard, while animal (Y) is a caracal. ( )
4. Animal (X) is covered with thick downy feathers, while animal (Y) is covered with thick white fur. ( )
5. Animal (X) is a penguin, while animal (Y) is a forest bear. ( )
6. Animal (X) is a penguin, while animal (Y) is a polar bear. ( )

9 Choose the animals that use camouflage adaptation to blend in with its environment :



a. Deer


b. Frog


c. Cow


d. Lizard

Exercises on Lesson 2

1 Choose the correct answer :

1. All of the following sentences represent the meanings of adaptation except ....
   a. it is the characteristics that help living things survive.
   b. it is the characteristics that help living things reproduce.
   c. it is the changes that help the animal to find a prey.
   d. it is the changes that causes the animal death.
2. The color of fur of fennec foxes protects them from ....
   a. wind. b. rains.
   c. hot Sun. d. cold weather.
3. Fennec foxes have a tan-colored coat that provides .... in their environments.
   a. camouflage b. respiration
   c. panting d. communication
4. Panting in fennec foxes belongs to .... adaptation.
   a. only structural b. only behavioral
   c. both structural and behavioral d. neither structural nor behavioral
5. Fennec foxes and arctic foxes live in burrows, this belongs to .... adaptation.
   a. only structural b. only behavioral
   c. both structural and behavioral d. neither structural nor behavioral
6. All the following properties help fennec foxes to stay cool except ....
   a. thick fur coat. b. make panting.
   c. tan-colored coat. d. extra-large ears.
7. Changing the color of body coat of arctic foxes according to season, is considered as a type of ....
   a. behavioral adaptation. b. change to the way of breathing.
   c. physical adaptation. d. change to the way of drinking.
8. All the following properties help arctic foxes to stay warm except ....
   a. thick fur coat. b. short ears.
   c. tan-colored. d. short legs.
9. Both fennec foxes and arctic foxes are similar in all of the following except ....
   a. they are live in the same habitat.
   b. they can eat different things.
   c. they have excellent hearing ability.
   d. they have different sized ears.
10. Bull sharks can live in ....
    a. fresh water only. b. salt water only.
    c. seas, rivers and mud. d. rivers, seas and oceans.

11 . From physical adaptation of bull sharks is that they ....

a. can live in both salt water and fresh water.
b. are flexible about what they eat.
c. hunt in the day as well as the night.
d. can live in salt water only.

12 . When a panther chameleon stands within leaves of trees, the color of its scales changes into .... color.

a. white
b. green
c. blue
d. black

13. Special eyes of the panther chameleon are belong to .... adaptation.

a. only structural
b. only behavioral
c. both structural and behavioral
d. neither structural nor behavioral

14. .... is considered as a behavioral adaptation in the panther chameleon.

a. Puffing up its body during danger
b. Each eye can move independently
c. V-shaped feet
d. Long sticky tongue

15 . All the following properties are considered as structural adaptations in the panther chameleon except its ....

a. each eye can move independently.
b. openning its mouth wide during danger.
c. V-shaped feet.
d. long sticky tongue.

2 Choose from column (A) what suits it in both columns (B) and (C) :

(A) Animal	(B) Adaptation	(C) How helps it
1. Chameleon	a. short ears and leg.	A. stay cool.
2. Fennec fox	b. V-shaped feet.	B. stay warm.
3. Arctic fox	c. difference in body colors.	C. balance and movement.
4. Bull shark	d. panting.	D. hide from its prey.

1. ...... → ......   2. ...... → ......   3. ...... → ......   4. ...... → ......

3 Put (✓) or (✗) :

1. Living organisms can adapt their environmental conditions through structural adaptation and behavioral adaptation. ( )
2. Fennec foxes and polar bears are similar in keeping their bodies cools through panting. ( )
3. When the snow melts in polar regions, the thick fur coat of arctic foxes turns black. ( )
4. The ears of arctic foxes are larger than that of fennec foxes. ( )
5. Fennec foxes stay in burrows during day, while arctic foxes stay in burrows during night. ( )
6. Both fennec and arctic foxes can eat insects, fruit, plant roots and left overs from other animal's prey. ( )
7. All types of sharks live in fresh water. ( )
8. Chameleon uses its tail and V-shaped feet to hunt and move. ( )
9. The panther chameleon has teeth and clows, through which it can hunt and eat its prey. ( )
10. The panther chameleon has a very long sticky tongue to hunt insects for feeding. ( )
11. Starred agama lizard use one of its eyes for searching for food and the other one to lookout for danger. ( )
12. The polar bear survive and reproduce in the same habitat of panther chameleon. ( )
13. Panting and staying in burrows are considered behavioral adaptations in fennec foxes. ( )
14. If a bull shark moves from a river to a sea, it will die. ( )

4 Complete the following table :

Animal	Its adaptation	Structural or Behavioral adaptation
1.	Blood vessels weave around each other.	....
2. Polar bear	Has thick, white fur.	Structural.
3.	Changes the color of its fur.	....
4. .... fox	Hiding inside burrows to stay cool.	....
5. Panther chameleon	Has eyes face opposite directions.	....

5 Write the scientific term of each of the following :

- 1. An animal has a tan-colored fur and panting like dogs. (......................)
- 2. A way by which fennec foxes cool themselves like dogs. (......................)
- 3. An animal that changes its fur color between winter and summer seasons. (......................)
- 4. Excellent places for arctic foxes to stay warm at night. (......................)
- 5. An animal that has multiple bright colors to provide camouflage in its environment and has V-shaped feet. (......................)
- 6. A shape of feet by which a panther chameleon holds tightly to branches and vines. (......................)
- 7. A feature in the bull shark, in which the upper surface of its body is darker than its lower surface. (......................)

6 Complete the following sentences :

- 1. Tan-colored coat in fennec fox is considered .... adaptation, while its panting to stay cool is considered .... adaptation.
- 2. Among animals that live in hot environments are .... foxes, while .... foxes live in cold environments.
- 3. Extra-large ears allow heat to escape to cool the bodies of .... foxes, while short ears and legs help the .... foxes stay warm.
- 4. Short ears of arctic fox is considered .... adaptation, while its staying in burrows to be warm is considered .... adaptation.
- 5. A burrow is an excellent place for the .... fox to stay warm at night and for the .... fox to stay cool during the day.
- 6. Different colors in bull shark's body is considered .... adaptation.
- 7. Weaving of vessels around each other in penguin's feet is considered .... adaptation.
- 8. The chance of bull shark to find a prey is more easier in .... water than in .... water.
- 9. Eyes of chameleon move independently of each other, this adaptation is considered as .... adaptation.
- 10. Chameleon puffs up its body with air for defense which is considered .... adaptation, while its V-shaped feet is considered .... adaptation.
- 11. The mouth of panther chameleon has no .... , but it has a very long sticky .... to hunt insects.

7 Give reasons for :

1. The fennec fox has a tan-colored coat.

....

2. Fennec foxes undergo panting.

....

3. Burrow is an excellent place for arctic and fennec foxes.

....

....

4. Fennec foxes have large ears, while arctic foxes have short ears.

....

....

5. Tan-colored coat of fennec fox is considered as a structural adaptation.

....

6. Panting in the fennec fox is considered as a behavioral adaptation.

....

7. Bull sharks have less competition for finding food in fresh water.

....

8. Panther chameleon has a V-shaped feet and a long tail.

....

8 What happens if ... ?

1. The arctic fox has a brown coat during the winter but it turns white during summer.

....

2. Fennec foxes have short ears and legs.

....

3. Sense of hearing becomes weak in foxes.

....

4. Arctic fox has only a white coat during all seasons of the year.

....

5. Both eyes of panther chameleon move in one direction only.

....

6. Panther chameleon is exposed to danger.

....

9 Cross out the odd word :

1. Penguin – Polar bear – Fennec fox – Arctic fox.
....
2. Fennec fox – Starred agama lizard – Panther chameleon – Bull shark.
....
3. Panther chameleon – Polar bear – Fennec fox – Arctic fox.
....

10 Compare between :

Points of comparison	Fennec fox	Arctic fox
1. Habitate :	....	....
2. Color of fur :	....	....
3. Shape of ears :	....	....
4. Time of entrance to burrows :	....	....

11 Put (S) in front of structural adaptation and (B) in front of behavioral adaptation for each of the following statements :

1. Tan coloration of fennec fox. (..............)
2. Living in burrows according to arctic fox. (..............)
3. Living of bull shark in both salt water and fresh water. (..............)
4. Countershading of bull shark. (..............)
5. Very long sticky tongue of panther chameleon. (..............)
6. Change the colors of panther chameleon scales in danger cases. (..............)

12 Give only one example of behavioral adaptation in each of the following animals :

1. Fennec fox : ....
....
2. Starred agama lizard : ....
....
3. Bull shark : ....
....
4. Panther chameleon : ....
....

13 **Study the following figure, then answer the questions :**



1. What is the name of this animal and where this animal live ?
....

2. Why the fur color of this animal changes between summer and winter seasons ?
....

3. Mention one structural adaptation and one behavioral adaptation in this animal to adapt with the climate :
   - Structural adaptation :
   ....
   - Behavioral adaptation :
   ....

Exercises on Lesson 3

1 Choose the correct answer :

1. Plants have .... that help them survive and grow in different environments.
   a. structural adaptation only
   b. physical adaptation only
   c. behavioral adaptation only
   d. physical and behavioral adaptation
2. It is difficult for rainforest plants to get ....
   a. water.
   b. wind.
   c. sunlight.
   d. oxygen.
3. From the behavioral adaptation of acacia tree is that ....
   a. it has one very long root.
   b. it has sharp spines among its leaves.
   c. it has very tall trunk.
   d. it producing poison to make a bad tasty leaves.
4. Acacia tree trunk and camel hump, ...
   a. both store water.
   b. both store fat.
   c. the first stores fat, and the second stores water.
   d. the first stores water, and the second stores fat.
5. One of the animals that may eat acacia leaves, is ....
   a. rat.
   b. caracal.
   c. penguin.
   d. giraffe.
6. All the following properties protect acacia leaves from being eaten by animals except that ....
   a. they are high enough.
   b. they are guarded by sharp spines.
   c. they are brightly colored.
   d. they produce a poison.
7. The acacia tree warning the other nearby acacia trees from animals by sending ....
   a. a watery message in the air.
   b. a watery message in the water.
   c. a smelly message in the air.
   d. a smelly message in the water.
8. When the nearby acacia trees recieve the smelly message from the acacia tree, which exposed to be eaten by animals, they ....
   a. start to lose water from their trunk.
   b. start to invite bats to eat their leaves.
   c. start to make a poisonous substance in their leaves.
   d. start to fall down their leaves.

9. Umbrella-shaped tree are ....
   a. mangrove tree and acacia tree.
   b. mangrove tree and kapok tree.
   c. acacia tree and kapok tree.
   d. barbary fig and water lilies.

10. The roots of kapok tree are not planted deeply in the soil, because ....
   a. the soil contains less water.
   b. the soil contains more water.
   c. the climate is very cold.
   d. the climate is very hot.

11. Kapok tree use the wind to carry its fluffy yellow seeds across its ....
   a. desert habitat.
   b. snowy habitat.
   c. salt water habitat.
   d. rainforest habitat.

12. If a plant grows in a dry desert, it needs .... to adapt for getting water.
   a. long branches
   b. long leaves
   c. long roots
   d. more sunlight

13. If a plant grows in a rainforest, where it is hard to reach sunlight. So, it needs .... to adapt for getting more sunlight.
   a. small roots
   b. a very tall trunk
   c. sharp spines
   d. a very short trunk

14. If a plant grows in a snow habitat. So, it needs all the following characteristics except .... to adapt this habitat.
   a. short branches
   b. triangular shape
   c. needle leaves
   d. wide leaves

15. All the following are adaptation of different plants to keep animals away from them except that they ....
   a. produce poison.
   b. gather their branches high above.
   c. have delicious-smelling flowers.
   d. have sharp spines.

16. Desert plants are characterized by all the following except that they ....
   a. store water.
   b. have wide leaves.
   c. have long roots.
   d. have sharp spines.

17. Palm tree has a tiny leaves like ....
   a. pine tree.
   b. kapok tree.
   c. acacia tree.
   d. water lily plant.

18. From the structural adaptation of water lily plant is that ....
   a. it has long roots.
   b. it has sharp spines.
   c. it has tiny leaves.
   d. it has wide leaves.

19. Pine tree has a triangular shape to make snow slides over its branches without breaking it. This structural adaptation makes this tree face the extreme cold climate like the feet of ....

a. caracal.
b. penguin.
c. fennec fox.
d. brown bear.

20. Barbary fig keeps animals away like acacia trees by its ....

a. sharp spines.
b. poison.
c. smell.
d. long leaves.

2 Choose from column (B) what suits it in column (A) :

1.

(A)	(B)
1. Hand-shaped leaves 2. Wind 3. Buttress roots	a. carries the kapok tree's fluffy yellow seeds across the forest. b. make kapok tree easy to find water. c. allow wind to move more gently through the leaves of kapok tree. d. help kapok tree stays upright in soggy soil.

1. .... 2. .... 3. ....

2.

(A)	(B)
1. Long and strong roots 2. Wide leaves 3. Needle shaped leaves 4. Sharp spines	a. prevent animals from eating barbary fig. b. make mangrove tree resists the water waves. c. allow snow slides easly over pine tree. d. allow water lilies absorb large amount of sunlight. e. prevent losage of water in pine tree.

1. .... 2. .... 3. .... 4. ....

3 Put (✓) or (✗) :

1. The rain falls for 6 monthes in southern African Savannah. (   )
2. Acacia tree has tiny leaves growing at the top of its taproot. (   )
3. The taproot of acacia tree grows deeply downward searching for water. (   )
4. Acacia leaves are protected from eaten by animals as they have brightly colored leaves. (   )
5. Acacia tree has long roots to hold it securely in the soil. (   )
6. Acacia tree and kapok tree used wind to send messages. (   )

7. Kapok tree has hand-shaped leaves. ( )
8. Sunlight transferes kapok tree's fluffy yellow seeds across the rainforest. ( )
9. From the structural adaptation of acacia tree is that it has a large, wide roots called buttress roots. ( )
10. Mangrove trees adapt to resist the water waves through their long, strong leaves. ( )
11. Water lily has wide leaves to absorb a large amount of sunlight. ( )
12. Pine trees live in desert habitat, adapt by having needle leaves to prevent losing of water. ( )
13. Thick roots are behavioral adaptation of palm trees to resist strong winds. ( )
14. Animals can't eat barbary fig due to its sharp spines. ( )
15. Plants of dry desert habitat adapt to store water. ( )
16. Sharp spines are adaptation of different plants to prevent animals from eating them. ( )

4 Write the scientific term of each of the following :

1. Structural adaptation of acacia tree that allows it to search for water. (..................)
2. Structural adaptation that guard the leaves of acacia tree to prevent animals from eating them. (..................)
3. Structural adaptation that fix the kapok tree in soggy soil and support its trunk. (..................)
4. The part of the kapok tree which is supported by the buttress roots. (..................)
5. A plant lives in salt water habitat and has long, strong roots to resist the water waves. (..................)
6. A plant lives in wet land habitat and has wide leaves to absorb a large amount of sunlight. (..................)
7. Structural adaptation in water lilies that absorb large amount of sunlight. (.............)
8. Structural adaptation that prevent the loss of water in pine tree. (..................)

5 Complete the following sentences :

1. Acacia tree defending itself by producing .... that makes leaves taste terrible while chameleon defending itself by puffing up its .... with air.
2. The leaves of .... tree in hot weather habitat store water, while the needle leaves of .... tree in snowy habitat prevent the loss of water.
3. The leaves of .... tree are look like your hand.
4. The shape of the kapok leaves allows .... to flow through them smoothly.
5. The kapok tree spreads the smell of its flowers to attract .... towards it.
6. Among the plants that can survive in habitats that have lackage of water are .... , ... and ....

7. Leaves of water lilies are wide in order to .... on the water surface and to absorb a large amount of ....
8. Drought regions are characterized by lacking of .... so, their plants adapt by having very long ....
9. The structural adaptation of .... tree can resist water waves, while the structural adaptation of .... tree can resist strong winds.
10. The structural adaptation of the leaves of .... plant allows it absorbs large amount of sunlight, while the structural adaptation of the leaves of .... tree allows wind to move easily through the leaves without tearing them.

6 Give reasons for :

1. Branches of acacia tree are gather on the top of its trunk.
....
....
2. Acacia tree have sharp spines.
....
....
3. Wind is important to acacia trees.
....
....
4. Kapok tree has hand-shaped leaves.
....
....
5. Kapok trees stay firmly rooted in the soggy soil although they are very tall.
....
6. Pine tree have a triangular shape.
....
....
7. Although snow falls in large quantities on the pine tree, its branches do not break easily.
....
....
8. Water lilies can absorb large amount of sunlight.
....
....

9. Palm trees can resist strong winds.

....

....

10. Barbary fig has sharp spines.

....

....

7 What happens if ... ?

1. The length of acacia taproot doesn't exceed 3 meters downward.

....

....

2. The acacia leaves are not guarded by sharp spines.

....

....

3. There are no buttress roots in the kapok tree.

....

....

4. The pine tree had an umbrella shape not a triangle shape.

....

....

5. Some plants of rainforest habitat became very short.

....

....

8 Cross out the odd word :

1. Taproot – Tiny leaves – Savannah – Buttress roots – Producing a poison.

....

2. Rainforest – Taproot – Hand-shaped leaves – Soggy soil – Buttress roots.

....

3. Cactus plant – Barbary fig – Palm tree – Mangrove tree.

....

4. Acacia tree – Polar bear – Penguin – Pine tree.

....

9 Compare between :

1.

Points of comparison	Acacia tree	Kapok tree
1. Type of roots :	....	....
2. Shape of leaves :	....	....

2.

Points of comparison	Kapok tree	Water lily	Pine tree
1. Habitat :	....	....	....
2. Shape of leaves :	....	....	....

10 Read the following paragraphs, then correct the underlined words :

1. Water lilies live in desert habitat so they have wide roots that float on the water surface to absorb large amount of water.

....

2. Plants of desert habitat have thick and short roots to resist the strong water waves and search for water such as pine trees and barbary fig plant.

....

3. Pine trees live in Savannah habitat, so they have long branches and needle leaves which prevent the plant from losing of sunlight.

....

11 Classify the following living organisms according to their habitat into organisms live in deserts and organisms live in forests in the table below :

(Starred agama lizard – Panther chameleon – Fennec fox – Kapok tree – Palm tree – Barbary fig plant)

Organisms live in deserts	Organisms live in forests
....	....
....	....
....	....
....	....

Exercises on Lesson 4

1 Choose the correct answer :

1. The needed energy to perform different functions of a living organism is obtained from ....
   a. breathing only.
   b. food processing only.
   c. breathing and running.
   d. breathing and food processing.
2. All the following are organs in the digestive system except ....
   a. mouth. b. nose. c. stomach. d. esophagus.
3. The stomach lies between esophagus and ....
   a. mouth. b. large intestine. c. small intestine. d. anus.
4. Which of the following organs is not included in breaking down of food? ....
   a. Mouth. b. Stomach. c. Lungs. d. Small intestine.
5. The role of teeth in digestion process is ....
   a. mixing the food. b. crushing the food.
   c. swallowing the food. d. moistening the food.
6. Crushing the food in your mouth is a function of ....
   a. stomach. b. tongue. c. saliva. d. teeth.
7. All the following are correct about the mouth except ....
   a. it is the first organ in the digestive system.
   b. it has teeth. c. it has tongue.
   d. it moves food to the stomach directly.
8. In the ...., saliva moistens food and begins to break it down.
   a. mouth b. esophagus c. small intestine d. stomach
9. Saliva in the mouth makes the food becomes soft and mushy with the help of ....
   a. teeth only. b. tongue only.
   c. teeth and esophagus. d. teeth and tongue.
10. The throat is connected to the stomach through ....
    a. esophagus. b. trachea. c. small intestine. d. large intestine.
11. The organ that moves the food into the stomach is ....
    a. mouth. b. tongue. c. esophagus. d. small intestine.

12. The food passes from the stomach to .... in order to complete the digestion process.
 a. esophagus b. small intestine c. large intestine d. anus
13. The stomach mixes the food with ....
 a. digestive juices only. b. stomach acid only.
 c. saliva and digestive juices. d. stomach acid and digestive juices.
14. The acid present in the stomach helps in ....
 a. absorption of digested food quickly. b. digestion of food.
 c. absorption of water from undigested food. d. crushing of food.
15. The liver and .... pour their juices into the small intestine.
 a. throat b. esophagus c. large intestine d. pancreas
16. Juices from liver and pancreas flow into ....
 a. mouth. b. stomach. c. small intestine. d. large intestine.
17. The organ that is long winding tube its length is about more than six meters is called ....
 a. large intestine. b. small intestine.
 c. esophagus. s. stomach.
18. The undigested materials of the food pass from the small intestine into ....
 a. the liver. b. the pancreas.
 c. the brain. d. the large intestine.
19. In the large intestine .... is absorbed from the undigested food.
 a. starch b. fats c. water d. oil
20. The solid wastes of undigested food become useless to the body, so the body must expel it outside the body through the ....
 a. mouth. b. small intestine.
 c. large intestine. d. anus.
21. The following pieces of advice keep the digestive system healthy except ....
 a. chewing food well.
 b. avoid eating much fast meals.
 c. drinking a little amount of water.
 d. practicing sports regularly.
22. Meat is much easier to be processed, so dogs have ....
 a. more than one stomach and a short digestive system.
 b. only one stomach and a short digestive system.
 c. more than one stomach and a long digestive system.
 d. only one stomach and a long digestive system.

23. The passage of air during inhalation is ....
   a. throat – nose – lungs – trachea.
   b. trachea –throat –lungs – nose.
   c. lungs – nose – throat – trachea.
   d. nose – throat – trachea – lungs.

24. The throat is connected to the lungs through ....
   a. esophagus. b. trachea. c. small intestine. d. ribs.

25. Inside the two lungs, at the end of the smaller air passages (bronchioles) there are tiny air sacs surrounded by ....
   a. air. b. water. c. small intestine. d. blood vessels.

26. The oxygen gas moves from air into blood at the ....
   a. nose. b. throat. c. trachea. d. lungs.

27. All the following are methods to keep the respiratory system healthy except ....
   a. breathing clean air. b. eating fruits rich in vitamin (A).
   c. eating orange and guava. d. avoid the smoking and smoking areas.

2 Choose from column (B) what suits it in column (A) :

1.

(A)	(B)
1. Esophagus	a. absorbs water from the undigested food to become solid waste.
2. Small intestine	b. mixes the food with an acid and digestive juices.
3. Large intestine	c. the digestion begins in it.
4. Stomach	d. food gets completely digested in it.
5. Mouth	e. is a tube has muscles that move the food down into the stomach.
	f. solid waste leaves the body through it.

1. .... 2. .... 3. ....
4. .... 5. ....

2.

(A)	(B)
1. Trachea 2. Blood 3. Diaphragm 4. Lungs	a. is a large muscle at the base of the ribs that help in process of exhaling and inhaling. b. are like balloons and they contain little sacs surrounded by blood vessels. c. carrying the oxygen to all body organs. d. is a tube that air travel down into the lungs through it. e. air enters the body through them.

1. .... 2. .... 3. .... 4. ....

3 Put (✓) or (✗) :

1. All animals are similar in shape and structure of their digestive systems. ( )
2. The digestive system consists of similar organs that work together to get nutrients from food. ( )
3. The human body gets oxygen gas from food. ( )
4. Mouth, nose, esophagus and the stomach are from the organs of the digestive system. ( )
5. The food passes through the large intestine before it goes into the small intestine. ( )
6. Digestion process begins in stomach with the help of saliva. ( )
7. The tongue and teeth moisten the food, while saliva crushes the food until it becomes soft. ( )
8. Food passes from mouth to stomach through a narrow tube known as small intestine. ( )
9. Food usually stays in stomach for few hours until it becomes a soupy liquid. ( )
10. Stomach connects esophagus with large intestine. ( )
11. Stomach mixes the food with juices that come from liver and pancreas. ( )
12. The food gets broken down into nutrients in the small intestine. ( )
13. Nutrients enter tiny blood vessels then blood carries them to all the parts of the body. ( )
14. Swallowing food without chewing keeps the digestive system healthy. ( )
15. Digestive system ends by anus. ( )
16. Grass is very easy to be digested. ( )

17. Dogs eat meat which is much easier to be digested, so dogs have short digestive system. ( )
18. During running the rate of breathing decreases. ( )
19. The air travels down into the lungs through esophagus. ( )
20. The inhaled air is rich in carbon dioxide gas, while the exhaled air is rich in oxygen gas. ( )
21. Exposing to air rich in dust harms the respiratory system. ( )

4 Write the scientific term of each of the following :

1. The organ where saliva moistens the food. (....................)
2. It presents in mouth and play an important role in crushing of food. (....................)
3. Liquid substance in your mouth that moistens the bite of food and begins to break it down. (....................)
4. The organ which receives the food from esophagus. (....................)
5. An organ that has tiny blood vessels to absorb the nutrients through its walls. (....................)
6. An organ through which solid wastes of digestion leaves the body. (....................)
7. A process through which the body gets oxygen from the air and expels out carbon dioxide. (....................)
8. A large muscle that contracts during breathing in and relaxes during breathing out. (....................)

5 Complete the following sentences :

1. The human body use .... system to get nutrients from food and use .... system to get oxygen from air.
2. The role of saliva in digestion process is ....
3. In order for food to become soft the .... and .... work to mix and grind (crush) the food well.
4. In the digestive system food becomes a soupy liquid in the .... , while it breaks down into nutrients in ....
5. The .... is a tube that has muscles to move the food down into the stomach, while .... is a long winding tube that the food gets completely digested inside it.
6. The longest part of the digestive system where most digestion takes place inside it is ....
7. The small intestine receives juices from .... and .... that help in digestion process.

8. The wall of the small intestine absorbs the digested food into your bloodstream through ....
9. In the digestive system, ... intestine absorbs the nutrients through its wall, while .... intestine absorbs water from undigested materials.
10. The .... formed in the large intestine are expelled out of the body through anus.
11. Cows have .... stomach - like organs in their digestive system for digestion of ....
12. Dogs have a .... digestive system than cows in length.
13. Air enters and exits the human body through .... system.
14. During inhalation, air travels down from your throat to your lungs through ....
15. At the base of your ribs there is a large muscle that plays an important role in respiration process known as ....
16. During inhalation process the diaphragm contracts and moves .... , while during exhalation process the diaphragm expands and moves ....

6 Give reasons for :

1. The human body is made up of different systems.

....

....

2. Although food is not digested inside the anus, it is an important organ in the digestive system.

....

....

3. A cow has long digestive system with lots of stomach-like compartments.

....

....

4. A dog has only one stomach and a much shorter digestive system than that of a cow.

....

....

5. Diaphragm has a great importance in respiration process.

....

....

7 What happens if ... ?

1. The small intestine is removed from the human body.

....

....

2. The nutrients absorbed by the wall of small intestine enters the tiny blood vessels.

....

....

3. Cows have sharp teeth and a short digestive system.

....

....

4. The diaphragm moves downward during inhalation.

....

....

5. The diaphragm moves upward during exhalation.

....

....

8 Cross out the odd word :

1. Saliva – Stomach – Esophagus – Small intestine. (..............)
2. Mouth – Lungs – Stomach – Large intestine. (..............)
3. Nose – Throat – Trachea – Anus. (..............)
4. Cow – One stomach – Dog – Sharp canine teeth. (..............)

9 Using the following table mention the name of the tube-shaped organs of the digestive and respiratory systems inside our bodies :

(A)	(B)
Organ (1)	through which food passes to the stomach.
Organ (2)	in which the absorption of nutrients takes place.
Organ (3)	it ends with anus.
Organ (4)	it connects the throat with the two lungs.

10 Compare between :

1.

Points of comparison	Inhalation	Exhalation
1. Diaphragm movement :	....	....
2. Size of chest cavity :	....	....
3. The air is rich in :	.... gas.	.... gas.

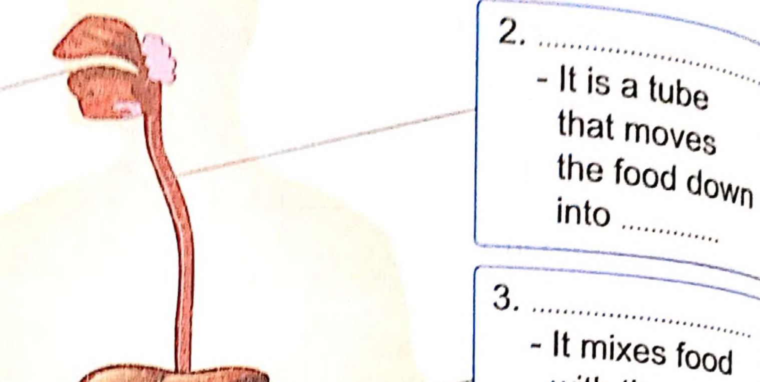
2.

Points of comparison	Cows	Dogs
1. Type of food :	....	....
2. Type of teeth :	....	....
3. Number of stomachs :	.... Stomach-like organs.	....
4. Length of digestive system :	....	....

11 Put (✓) in front of the name of the system to which each of the following organs belongs :

The organ	The system	
	Digestive	Respiratory
1. Trachea	....	....
2. Anus	....	....
3. Stomach	....	....
4. Lungs	....	....
5. Small intestine	....	....
6. Esophagus	....	....
7. Diaphragm	....	....
8. Nose	....	....
9. Large intestine	....	....
10. Liver	....	....
11. Pancreas	....	....

12 Mention the name of each organ, then complete the sentences below :



1. ....
- It has .... that moistens the food.

2. ....
- It is a tube that moves the food down into ....

3. ....
- It mixes food with the .... acid and .... juices.

4. ....
- It receives juices from .... and ...., which help break down of food into ....

5. ....
- It absorbs .... from .... food.

6. ....
- It helps the body to get rid of solid ....

13 The following figures represent the respiratory system :

(1) Which figure represents inhalation. (.............)

(2) Which figure represents exhalation. (.............)

(3) In figure (a) .... muscle contracts and the size of chest ....

(4) The air that comes out in figure (b) is rich in .... gas.

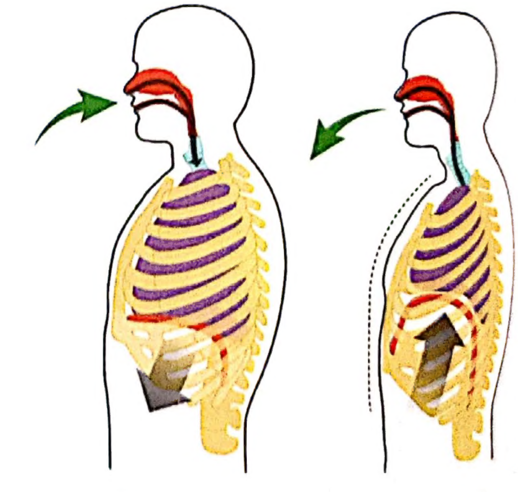


Fig. (a) Fig. (b)